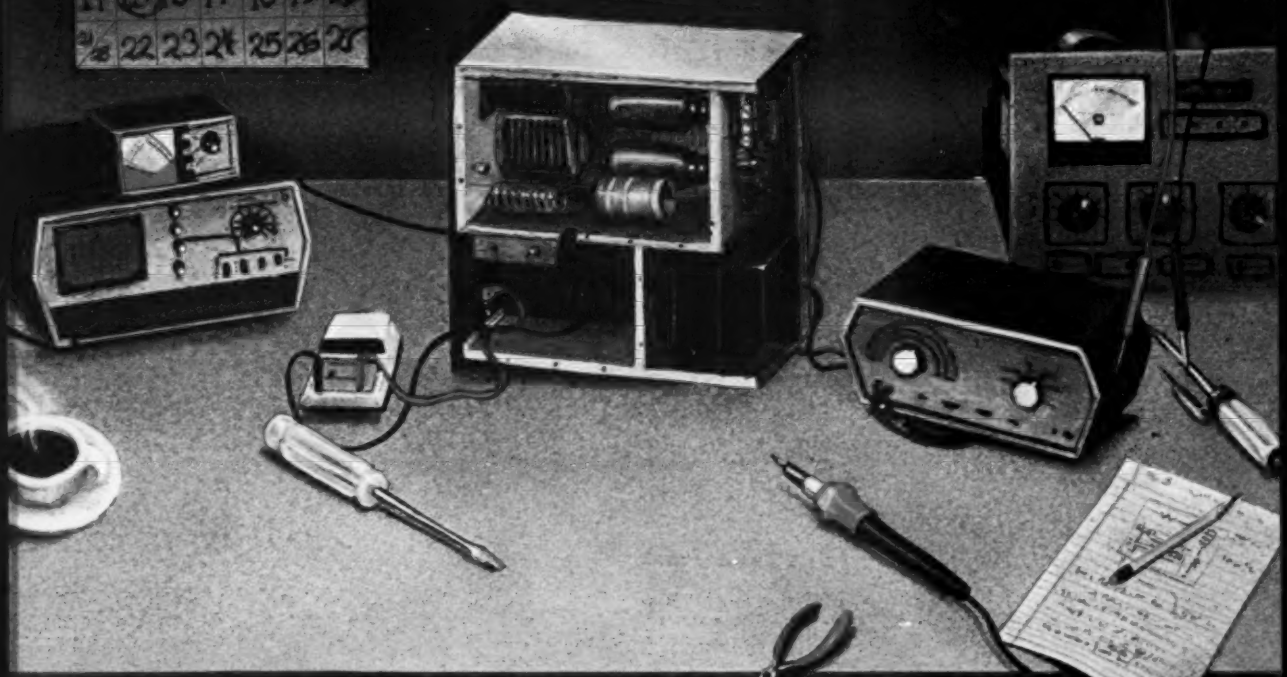
February 1982 $2.95

73 MAGAZINE
FOR RADIO AMATEURS

Cash Bonus for Builders! Page 6



Also:

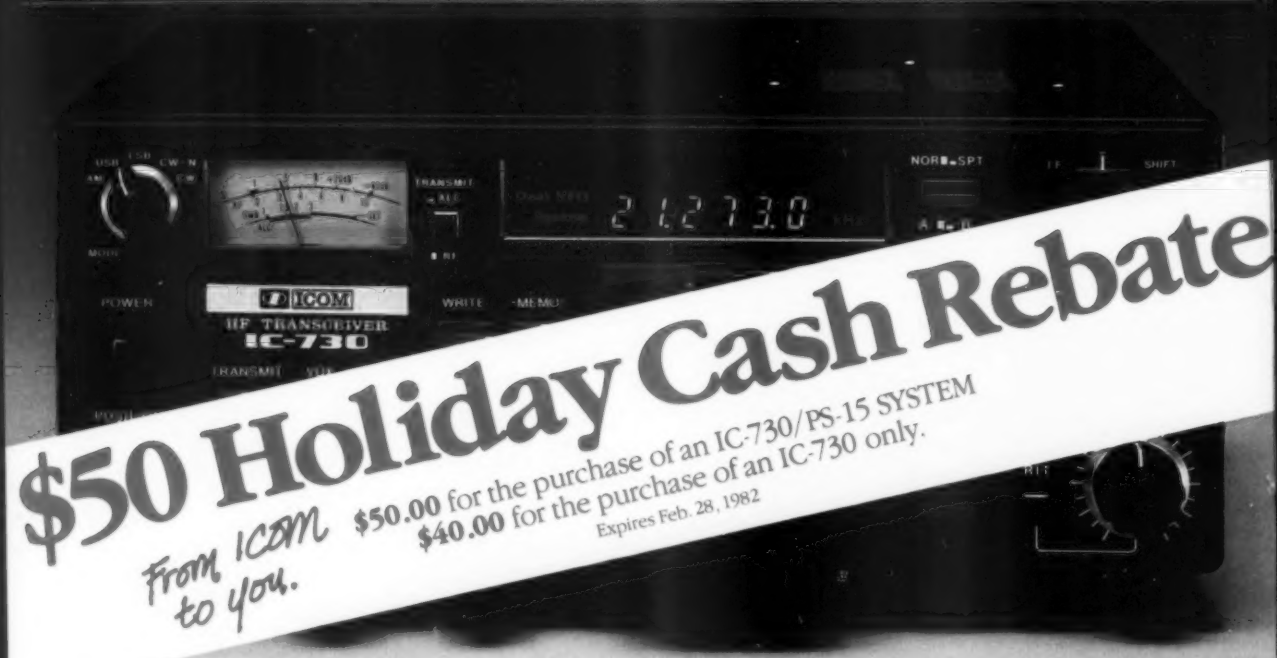
Solving the Bobtail Riddle

Requiem for Major Armstrong

0 02
74470 65946

ICOM IC-730

ICOM's Go-Anywhere HF Rig for Everyone's Pocketbook



$50 Holiday Cash Rebate

From ICOM to you.

$50.00 for the purchase of an IC-730/PS-15 SYSTEM
$40.00 for the purchase of an IC-730 only.

Expires Feb. 28, 1982

Compact.

Only 3.7 in (H) x 9.5 in (W) x 10.8 in (D) will fit into most mobile operations (compact car, airplane, boat, or suitcase)

Affordable.

Priced right to meet your budget as your main HF rig or as a second rig for mobile/portable operation.

Convenient.

- Unique tuning speed selection for quick and precise QSY, choice of 1 KHz, 100 Hz or 10 Hz tuning.
- Electronic dial lock, deactivates tuning knob for lock on, stay on frequency operation.
- One memory per band, for storage of your favorite frequency on each band.
- Dual VFO system built in standard at no extra cost.

Full Featured.

- 200W PEP input—powerful punch on SSB/CW (40 W out on AM)
- Receiver preamp built-in • VOX built-in
- Noise blanker (selectable time constant) standard
- Large RIT knob for easy mobile operation
- Amateur band coverage 10-80M including the new WARC bands
- Speech processor—built-in, standard (no extra cost)
- IF shift slide tuning standard (pass band tuning optional)
- Fully solid state for lower current drain
- Automatic protection circuit for finals under high SWR conditions
- Digital readout • Receives WWV • Selectable AGC
- Up/down tuning from optional microphone
- Handheld microphone standard (no extra cost)
- Optional mobile mount available

ICOM

2112 116th Avenue N.E., Bellevue, WA 98004
3331 Towerwood Dr., Suite 307, Dallas TX 75234

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

CALL US FIRST! CASH-IN ON 5-STORE BUYING POWER!

FAST SHIPMENT POPULAR ITEMS FROM HUGE STOCKS.
QUANTITY BUYING MEANS TOP DISCOUNTS, BEST PRICES.

Amateurs world-wide are taking advantage of our fast service and special prices.

SERVING HAMS BETTER.
North...south...east...west.

Bob Ferrero, W6RJ/K6AHV, Jim Rafferty, N6RJ other well known hams give you courteous, personalized service.

FREE PHONE
800
854-6046
9:30AM to 5:30PM
PACIFIC TIME
Monday thru Saturday.
CALIF. CUSTOMERS PLEASE CALL OR VISIT LISTED STORES
FREE SHIPMENT
(UPS Brown)
CONTINENTAL U.S.A.

master charge | VISA

KENWOOD

SAVE ***substantially! Call now for your price***

TR-2500

TS-130S

TR-7850

TS-830S

R.L. DRAKE TR-7/DR-7

- Continuous receiver coverage, 1.5-30MHz.
- Transmit coverage: All amateur bands, 160 thru 10 meters. Optional program board for MARS, commercial, government, future ham bands.
- Up-conversion w/I-F of 48.05MHz. Hi-level balanced mixer front end for superior strong signal handling performance.
- True passband tuning.
- Standard 2.3kHz filter w/space for 3 optional crystal filters, push-button selected.
- Broadband, full solid-state design.
- Rugged, built-in solid-state power amplifier.
- SSB (w/USB/LSB), AM, CW, RTTY.

NEW! YAESU FT-ONE HF TRANSCEIVER

- General coverage receiver, 150kHz to 29.999MHz.
- Transmit coverage: Nine present and proposed bands.
- Keyboard freq. entry. Fully digitally synthesized. Main tuning dial or push-button scanner in 10 or 100Hz steps.
- Dual VFO's.
- Full CW break-in.
- Up conversion w/first I-F at 73MHz.
- Diode ring first mixer.
- Optional 600Hz or 300Hz crystal filters.
- Variable bandwidth.
- I-F shift.
- Speech processor.
- Digital readout for VFO, memory chan., RIT offset.
- Noise blanker.
- 240W pep input, SSB.
- 115/220VAC or 13.5DC operation.

CALL FOR YOUR PRICE

HAM RADIO OUTLET™

ANAHEIM, CA 92801
2620 W. La Palma,
(714) 761-3033 (213) 860-2040
Between Disneyland & Knott's Berry Farm

BURLINGAME, CA 94010
999 Howard Ave., (415) 342-5757
5 miles south on 101 from S.F. Airport.

OAKLAND, CA 94609
2811 Telegraph Ave., (415) 451-5757
Hwy 24 Downtown. Left 27th off-ramp.

SAN DIEGO, CA 92123
5375 Kearny Villa Road (714) 560-4900
Hwy 163 & Clairemont Mesa Blvd.

VAN NUYS, CA 91401
6265 Sepulveda Blvd., (213) 988-2212
San Diego Fwy at Victory Blvd.

OVER-THE-COUNTER
Mon. thru Sat. 10AM to 5:30PM

AEA • ALLIANCE • ALPHA • AMECO • AMPHENOL • ARRL • ASTRON • AVANTI • BENCHER • BERK-TEK • BIRD • B&W • CALLBOOK • CDE • COLLINS • CUBIC • CURTIS • CUSHCRAFT • DAIWA • DATONG • DENTRON • DRAKE • DX ENGINEERING • EIMAC • HUSTLER • HY-GAIN • ICOM • J.W.MILLER • KENWOOD • KLM • LARSEN • LUNAR • METZ • MFJ • MICRO • LOG • MINI • PRODUCTS • MIRAGE • NYE • PALOMAR • ROBOT • ROHN • SHURE • SWAN • TELEX • TELREX • TEMPO • TEN-TEC • TRISTAO
YAESU and many more!

ETO ALPHA

All ALPHA amplifiers are in stock for fast delivery
CALL FOR SPECIAL PRICES

COLLINS/ROCKWELL KWM-380

Limited quantity priced lower than current dealer wholesale.

Prices are increasing!
PHONE TODAY. SAVE!

Prices, specifications, descriptions subject to change without notice. Calif. residents please add sales tax.

INFO

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for 73" guidelines are available upon request.

Editorial Offices:

Pine Street
Peterborough NH 03458
Phone: 603-924-3873, 924-3874

Advertising Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-7138

Circulation Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-7296

Subscription Rates

In the United States and Possessions:
One Year (12 issues) $25.00
Two Years (24 issues) $38.00
Three Years (36 issues) $53.00

Elsewhere:

Canada—$27.00/1 year only, U.S. funds. Foreign surface mail—$35.00/1 year only, U.S. funds. Foreign air mail—$62.00/1 year only, U.S. funds.

To subscribe, renew or change an address:

Write to *73 Magazine*, Subscription Department, PO Box 931, Farmingdale NY 11737. For renewals and changes of address, include the address label from your most recent issue of 73. For gift subscriptions, include your name and address as well as those of gift recipients. Postmaster: Send form #3579 to *73 Magazine*, Subscription Services, P.O. Box 931, Farmingdale, NY 11737.

Subscription problem or question:

Write to *73 Magazine*, Subscription Department, PO Box 931, Farmingdale NY 11737. Please include an address label.

73 Magazine (ISSN 0098-9010) is published monthly by 73, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Copyright (c) 1981 by 73, Inc. All rights reserved. No part of this publication may be reprinted or otherwise reproduced without written permission from the publisher. Microfilm Edition—University Microfilm, Ann Arbor MI 48106.

Antenna Baluns

Model PB $14.95

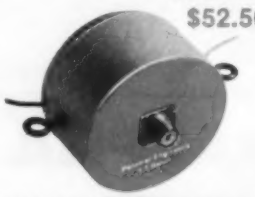
350 watts PEP. 1.7 to 30 MHz. Low cost. High performance. Just right for transceivers. Specify desired ratio from table below:

Model	Ratio	Matches 50 ohms to
PB-1	1:1	50 ohms
PB-1.5	1.5:1	75 ohms
PB-2	2:1	100 ohms
PB-3	3:1	150 ohms
PB-4	4:1	200 ohms
PB-5	5:1	250 ohms
PB-6	6:1	300 ohms
PB-7.5	7.5:1	375 ohms
PB-9	9:1	450 ohms
PB-12	12:1	600 ohms
PB-16	16:1	800 ohms

Model 1K
$32.50

1 Kw CW, 3Kw PEP input. 1:1 or 4:1

Model 2K
$52.50



2 Kw CW, 6 Kw PEP input. 1:1 or 4:1

Beam Balun
$57.50

2 Kw CW, 6 Kw PEP input. 1:1 or 4:1

VISA MasterCard

Send for FREE Catalog

To order, add $3 shipping/handling. California residents add sales tax.

Palomar Engineers

1924-F West Mission Rd., Escondido, CA 92025 • (714) 747-3343

The Fun-Oscillator
—a simple, goof-proof vfo for your QRP transmitter.....WA0RBR **12**

Build this Antennalyzer
—you'll need a weekend.....W1BG **16**

The Father of FM
—the tragic story of Major E. H. Armstrong .....Hammond **50**

The Art of Listening
—audio accessories explored.....W8FX **64**

A Dish Antenna Anyone Can Build
TV —no hyperbole, just a parabola W8DJY **88**

feb. 82
73 MAGAZINE

Police Freqs for the TR-2400
—a sleepless night for the mod squad N9AKX **26**

Those Amazing Bobtails
—the current-fed connection.....W1XU **30**

Shoot the Moon!
—visual tracking for your EME array W9CGI **34**

CQ MARS de IC-2A
—work new worlds.....WD8JLW **46**

Job's Own LNA
TV —rolling your own takes patience WA4CVP, WA4OSR **92**

Microwave Master
TV —you might not need a mountaintop.....WB4APC **96**

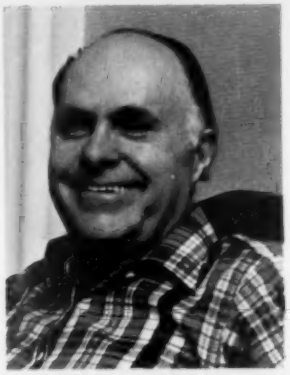
CW Interface
—let your computer do the copying W9JD **104**

Never Say Die—6, Social Events—48, OSCAR Orbits—83, Ham Help—98, 122, 139, Reader Service—114, Review—118, Letters—120, Fun!—123, Awards—125, Kahaner Report—127, Contests—128, RTTY Loop—134, New Products—135, Propagation—178

Cover: Pastel illustration by William Geise, Wilton NH.

W2NSD/1
NEVER SAY DIE

editorial by Wayne Green



NOW, THE GOOD NEWS

The easy passage of the Goldwater ham bill through the Senate was certainly good news... and will bring closer some badly needed changes in the fundamental rules by which the FCC has had to operate.

Another bright spot was a bill entered in the House (in November) by Rep. Timothy Wirth of Colorado. Let me give you quotes on some of the provisions of this bill...

Authorize use of amateur volunteers for examination preparation

Section 4(f) is amended by adding at the end thereof the following new subsections:

"4(f)(4) Notwithstanding the provisions of Part III of Title 5, United States Code or 31 U.S.C. §665(b), for purposes of administering any examination for an amateur station operator license, the Commission may accept and employ the voluntary and uncompensated services of any individual who holds an amateur station operator license of an equal or higher class than the class license for which the examination is being prepared. Any person who provides services under this paragraph shall not be considered, by reason of having provided such services, a Federal employee for any purpose."

Explanation

This proposal would provide a statutory basis for present practice at the Commission, and would allow expansion in the Commission's use of volunteers. The amendment would have no discernible effect on our budgetary requirements.

"4(f)(5) Notwithstanding the provisions of Part III of Title 5, United States Code or 31 U.S.C. §665(b), for purposes of administering any examination for any amateur station operator license, the Commission may accept and employ the voluntary and uncompensated services of any individual who holds an amateur station operator license of an equal or higher class than the class license for which the examination is being conducted. Any person who provides voluntary and uncompensated services under this paragraph shall not be considered, by reason of having provided such services, a Federal employee for any purpose."

Explanation

The present practice of the Commission is to permit volunteer licensees holding an Amateur Extra, Advanced, or General Class license who are at least 18 years of age to administer Novice Class operator license examinations. The proposed amendment would give statutory recognition to this practice and would allow the Commission to extend the practice to examinations for other classes, at the discretion of the Commission.

This program would help to conserve Commission resources and additional benefits would result from the fact that applicants would likely be able to take examinations within their communities, as opposed to having to travel to FCC field offices for testing.

Once the FCC has been authorized to let amateurs prepare and administer exams, we have the path open to set up a system whereby certain clubs might be able to hold classes to teach the needed theory, rules, and operation skills to prospective hams... followed by oral exams and a demonstration of skills.

While there are some amateurs who believe that the tension and panic of an FCC-administered exam are beneficial in some way, that was not my experience...nor the experience of anyone I've talked with about it. There seems to be a general concept that we should do everything possible to keep enthusiastic people out of the hobby rather than doing all we can to interest people in it... and making their entry an enjoyable experience.

There seems to be some wariness that we will suddenly find ourselves with a system where we are bringing in people who will be rotten hams and thus spoil the hobby. I would say two things to those worriers... first, we already have a fine system for bringing in lousy hams, one which has been working with a high degree of perfection. One has only to visit Los Angeles to get the full flavor of the 1980s-type ham in full bloom. It should be obvious that the present system of filtering out the weirdos is not working worth beans.

Secondly, I know of no one interested in opening the flood gates to CBers to come into amateur radio for a free ride. Not even CBers have suggested anything that preposterous. I do hear hams opposing it, but these chaps are merely fighting their own straw man, not anything ever seriously proposed. If some hams are gullible enough to get excited over such ma-

$$ HOME-BREW CONTEST $$

For some of us, there is no more satisfying experience than designing and building a piece of electronic gear. Now there's a chance for you home-brewers to receive special recognition for your achievements. It's the *73 Magazine* Home-Brew Contest.

Between now and April 1, we'll be looking for articles describing the best home-brew projects in the land for under $100. All useful projects will be published in *73*, and the cream of the crop will share $500 in cash prizes. Top prize in the contest is $250, with $100 going to the second place project and $50 to each of three honorable mentions. These prizes are over and above the payment that all authors receive for having their articles published in *73*.

Contest Rules

1. All entries must be received by April 1, 1982. To enter, write an article describing your best home-brew construction project, and submit the article to *73 Magazine*. Any construction article received before the April 1 deadline is automatically entered in the contest. If you haven't written for *73* before, please send an SASE for a copy of our author's guide.
2. The total cost of the project must not exceed $100, even if all parts are puchased new. Be sure to include a detailed parts list, with prices.
3. All parts used in the project must be available to the average radio amateur or electronics experimenter. To be on the safe side, include sources for any unusual components.
4. Projects will be judged by the *73* technical staff on the basis of usefulness, reproducibility, economy of design, and clarity of presentation. The decision of the judges is final.
5. All projects must be original, i.e., not previously published elsewhere.
6. All rights to articles purchased for publication become the property of *73 Magazine*.

Send your entries to:

Home-Brew Contest
73 Magazine
80 Pine Street
Peterborough NH 03458

Winners will be announced in the June, 1982, issue of *73*. Have fun!

Digital world clock with two 24-hour displays, quartz time base

The HC-10 digital world clock with dual 24-hour display shows local time and the time in 10 preprogrammed plus two programmable time zones.

R-600

"Now hear this"... digital display, front speaker, easy tuning

The R-600 is a high performance, general coverage communications receiver covering 150 kHz to 30 MHz in 30 bands, at an affordable price. Use of PLL synthesized circuitry provides high accuracy of frequency with maximum ease of operation.

R-600 FEATURES:

- 150 KHz to 30 MHz continuous coverage, AM, SSB or CW.
- 30 bands, each 1 MHz wide, for easier tuning.
- Five digit frequency display, with 1 KHz resolution.
- 6 kHz IF filter for AM (wide), and 2.7 kHz filter for SSB, CW and AM (narrow).
- Up-conversion PLL circuit, for improved sensitivity, selectivity, and stability.
- Communications type noise blanker eliminates "pulse-type" noise.
- RF Attenuator allows 20 dB attenuation of strong signals.
- Tone control.
- Front mounted speaker.
- "S" meter, with 1 to 5 SINPO - S scale, plus conventional "S" meter scale.
- Coaxial, and wire antenna terminals for low impedance (50 Ω). Wire terminals for high impedance (500 Ω).
- 100, 120, 220, and 240 VAC, 50/60 Hz. Selector switch on rear panel.
- Optional 13.8 VDC operation, using DCK-1 cable kit.
- Other features: carrying handle, headphone jack, and record jack.

OPTIONAL ACCESSORIES:

- DCK-1 DC Cable kit.
- SP-100 External Speaker.

R-1000

"Hear there and everywhere"... easy tuning, digital display

The R-1000 is an amazingly easy-to-operate, high-performance, communications receiver, covering 200 kHz to 30 MHz in 30 bands. This PLL synthesized receiver features a digital frequency display and analog dial, plus a quartz digital clock and timer.

R-1000 FEATURES:

- Covers 200 kHz to 30 MHz continuously.
- 30 bands, each 1 MHz wide.
- Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
- Built-in 12-hour quartz digital clock with timer to turn on radio for scheduled listening or control a recorder through remote terminal.
- Step attenuator to prevent overload.
- Three IF filters for optimum AM, SSB, CW. 12-kHz and 6-kHz (adaptable to 6-kHz and 2.7-kHz) for AM wide and narrow, and 2.7-kHz filter for high-quality SSB (USB and LSB) and CW reception.
- Effective noise blanker.
- Terminal for external tape recorder.
- Tone control.
- Built-in 4-inch speaker.
- Dimmer switch to control intensity of S-meter and other panel lights and digital display.
- Wire antenna terminals for 200 kHz to 2 MHz and 2 MHz to 30 MHz. Coax terminal for 2 MHz to 30 MHz.
- Voltage selector for 100, 120, 220, and 240 VAC. Also adaptable to operate on 13.8 VDC with optional DCK-1 kit.

OPTIONAL ACCESSORIES:

- SP-100 matching external speaker.
- HS-6 lightweight, open-air headphone set.
- HS-5 and HS-4 headphones.
- DCK-1 modification kit for 12-VDC operation.

SP-100

R-1000

HS-5

KENWOOD

TRIO-KENWOOD COMMUNICATIONS

1111 West Walnut, Compton, California 90220

STAFF

PUBLISHER/EDITOR
Wayne Green W2NSD/1
EXECUTIVE VICE PRESIDENT
Sherry Smythe
ASSISTANT PUBLISHER/EDITOR
Jeff DeTray WB8BTH
ASSOCIATE PUBLISHER/DIRECTOR OF PUBLICATIONS
Edward Ferman WA1UFY
MANAGING EDITOR
John Burnett
ASST. MANAGING EDITOR
Susan Philbrick
EDITORIAL ASSISTANTS
Nancy Noyd
Richard Phanix
CONTRIBUTING EDITORS
John Ackermann AG9V
Tim Daniel N8RK
Larry Kahaner WB2NEL
ADMINISTRATIVE ASSISTANT
Pat Graham
ASSOCIATES
Robert Baker WB2GFE
Bill Gosney KE7C
Sanger Green
Dave Ingram K4TWJ
Joe Kasser G3ZCZ
Dr. Marc Leavey WA3AJR
Bill Pasternak WA6ITF
Peter Stark K2OAW

PRODUCTION MANAGER/ PUBLICATIONS
Nancy Salmon
ASST. PRODUCTION MANAGERS/PUBLICATIONS
Dennis Christensen
Michael Murphy
ADVERTISING GRAPHICS MANAGERS
Steve Balshein
Bruce Hedin
Jane Preston
PRODUCTION
Frances Benton
Fiona Davies
Linda Drew
Sandra Duarte
Matt Hale
Dianne Ritson
Patricia Mackowsky/Allen
Theresa Osbeb
Betty Smith
Deborah Stone
Irene Vail
Judi Wimberly
Donna Wohlfarth
PHOTOGRAPHY
William Heydolph
Paul Babicki
Kathy Birkebak
Bryan Hastings
Thomas Villeneuve
TYPESETTING
Sara Bedell
Debbie Davidson
David Hayward
Kelly Smith
Karen Stewart
Michele DesRochers
Steve Jewett

CORPORATE CONTROLLER
Roy A. Johnson
EXECUTIVE ASSISTANT
Leatrice O'Neil
ACCOUNTING MANAGER
Knud Keller KV4GG/1
CIRCULATION MANAGER
Debra Soudrieau
CIRCULATION
Doris Day
603-924-7296
Pauline Johnstone
BULK SALES MANAGER
Gimmie Boudrieau
ADVERTISING
603-924-7138
Jim Gray W1XU, Mgr.
Nancy Ciampa, Asst. Mgr.
Ross Kenyon KA1GAV
Cornelia Taylor

neuvers, then we should consider them part of the problem, not part of any solutions.

No, I think it is plain to just everyone that our present licensing system stinks. Here we have a Morse code test which a four-year old has passed with flying colors...big deal filter. We have a technical exam that few people even bother to study for...why bother when you can buy the test answers from Bash and just memorize the answers? That includes questions on rules, so we don't even have to know them anymore. It is no wonder that we have jamming of repeaters, foul language on the bands, stupid pileups of DX stations, and a situation on two meters in Los Angeles that has to be heard to be believed.

Not only are things going to hell in a basket, but we have the spectacle of thousands of hams doing all they can to protect this terrible system and make sure that we get even more of the same kind of hams.

Yes, I do have some ideas on what to do about the situation. And I think they will work. They certainly are right up the alley of the current FCC changes. The Commission has two major interests these days...deregulation and cutting expenses. I think that we can take advantage of these and at the same time improve amateur radio substantially.

Let's take a look at some basics. Firstly, yes...we do have some terrible hams in our ranks. But we recognize that, as much of a pain in the ass as these bums are, they are a distinct minority. Okay...there's a hint for us...a clue on how to start getting out of this miserable situation.

To me, one of the foundations of amateur radio is the ham club. I believe that every ham should belong to and support a ham club. This is one of the big strengths we have. This also is a key to our separating the good from the bad and the ugly, for few of the really bad eggs ever join clubs. The same behavior which makes them despicable on the air keeps them from having friends off the air. And what few do have the guts to come to club meetings, knowing what others think of them, are not thought well of for it. Thus, I suspect that the more we can involve our clubs in the training and licensing of newcomers, the better class of hams we will have on our bands. Perhaps we could even consider some sort of trial period for newcomers before their licenses are permanent so that we could observe them on the air.

We already know that the most vicious and obnoxious of people are quite capable of learning the code. In fact, since some of the worst hams we have had have been Extra class, perhaps there is some correlation between ugliness and adaptability to code (I'm kidding... aren't I?). I think that CW is one of the most treasured aspects of amateur radio, but I also think that the ability to copy the code is meaningless as far as determining whether someone is going to be a good ham. I think that once we make code ability honorable and stop forcing people to learn it for the test, we will take a lot more pride in it. Who can really take pride in something which he has to do, whether he wants to or not?

Clubs are an answer to many of our problems. If we are going to get amateur radio into any serious growth pattern we are going to have to have many more and stronger ham clubs. I would like to see ham clubs set up in every high school in the country. I'd like to know that every ham club has classes to teach newcomers the theory, the rules, and how to operate. If the Wirth bill goes through, it will open the way for clubs not only to teach the fundamentals of amateur radio, but also to make up and administer the exams. Talk about a service being self-sustaining!

This also would cut the cost to the FCC substantially. I don't know how much they are paying their people to keep writing new test questions to try to stay ahead of Bash and his cheatsheets, but it must be a substantial amount. Then there is the cost of printing and distributing the tests. If the field personnel of the Commission did not have to sit around and administer exams they would be freed up for more productive work...or even to go into the private sector and earn money for taxes instead of spending it. We sure have a need for engineers and technicians these days in industry...a desperate need.

Monitoring

Another provision of the Wirth bill is as follows....

Authorize use of amateur volunteers for monitoring

"4(f)(6) For purposes of monitoring any violation of any provision of this Act, and of any regulation made by the Commission pursuant to this Act, relating to the amateur radio service, the Commission, notwithstanding any provisions of Part III of Title 5, United States Code or 31 U.S.C. § 665(b), may (i) recruit and train any individual licensed by the Commission to operate an amateur station; and (ii) accept and employ the voluntary and uncompensated services of such individual. For purposes of recruiting and training such individual, the Commission may also accept and employ the voluntary and uncompensated services of any amateur station operator organization. Any person who provides voluntary and uncompensated services under this paragraph shall not be considered, by reason of having provided such services, a Federal employee for any purpose."

Explanation

The volunteers' monitoring authority should include the monitoring of amateur licensees transmitting on frequencies not assigned to the service and is intended to permit volunteers to collect violation reports and annotate and summarize them for the convenience of the FCC.

Enactment of this proposal would enhance the Commission's enforcement efforts and bolster efforts to detect and prosecute rule violators. To ensure that a volunteer monitoring program helps rather than hinders the enforcement program, it is important that violation reports undergo preliminary review by volunteer organizations to help FCC personnel determine which alleged violations represent the most promising targets for the Commission's limited enforcement resources.

This amendment would not increase our budgetary requirements. It may help us to conserve our enforcement resources or, at least, improve the efficiency of our enforcement program.

If the Commission is to fully utilize the services of volunteer amateur licensees for monitoring, as envisioned by this proposal, there should be *an exception to Section 605 to permit the monitoring groups to receive and disclose information transmitted by amateur licensees and operators. (See proposed amendment to Section 605, infra.)*

Exempt amateur radio communications under certain circumstances

Section 605 is amended by striking the last sentence thereof and adding the following:

Continued on page 131

Introducing the first fully programmable keyer

Store commands, as well as text, for automatic execution

The Heathkit μMatic Memory Keyer's custom microprocessor stores up to 240 characters of text or commands. *Variable-length buffers* eliminate wasted memory space. "Command strings" allow text to be stored in several buffers, then strung together in any sequence for most efficient use of memory. Command strings can also select speed, weight, spacing and auto-repeat count.

No external key to buy

Integral capacitive "touch" paddles unplug and store in their own compartment inside the Keyer when not in use. Left handed? A touch of the key-pad and the paddles are reversed. Choose any speed between 1 and 99 words per minute, and any of 11 weight settings. Special rear-panel jack connects mechanical paddle.

Great code practice machine, too

A "practice" mode sends random code groups of random length and selectable types for a total of 6,400 different practice sessions. Each sequence sends approximately 3,000 characters before repeating.

Other features:

Built-in sidetone oscillator and speaker have pitch and volume controls. Phone jack and earphone are included for private listening. Complete details on the great new μMatic Memory Keyer are in the latest Heathkit Catalog. Or see it at your nearby Heathkit Electronic Center.*

Send for free catalog

Write to Heath Company,
Dept. 011-864, Benton Harbor, MI.
In Canada, contact Heath Company,
1480 Dundas Street E., Mississauga, ONT L4X 2R7.

Visit your Heathkit Store

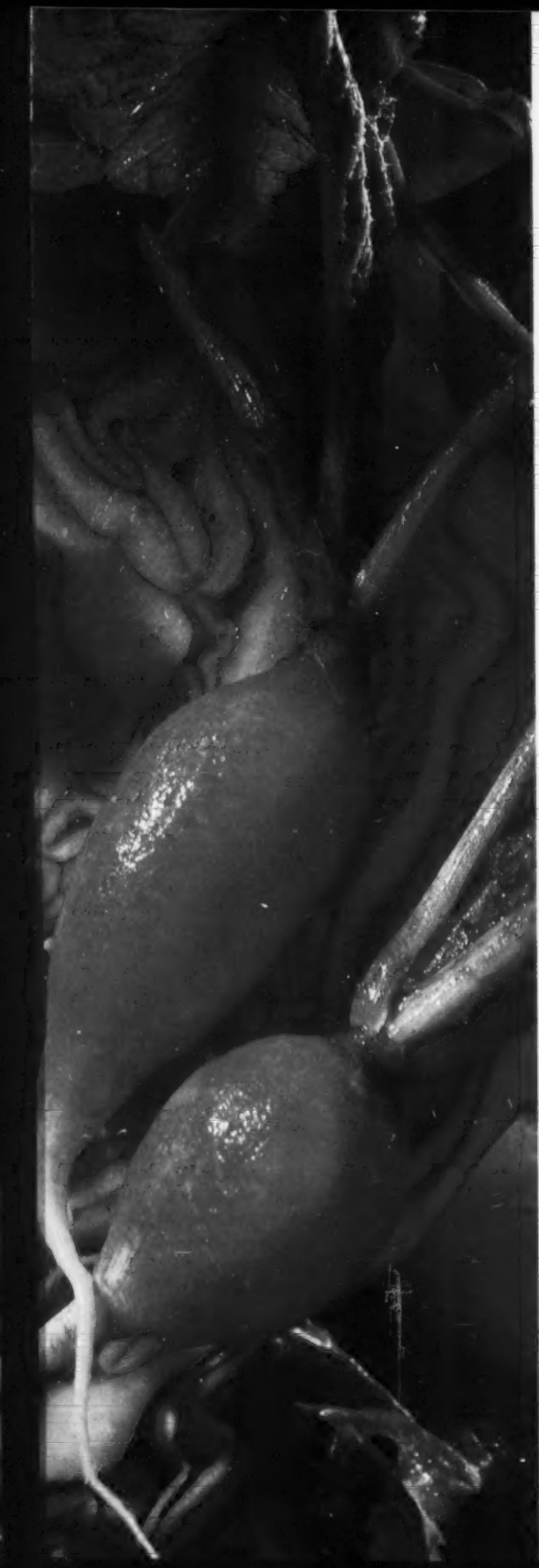
Where Heathkit products are displayed, sold and serviced. See your telephone white pages for locations.

*Units of Veritechnology Electronics Corporation in the U.S.

Heathkit®

-303

LM-358
COM SPEC
IC-107
LM-324
COM SPEC
IC-107
LM-358



A fresh idea!

Our new crop of tone equipment is the freshest thing growing in the encoder/decoder field today. All tones are instantly programmable by setting a dip switch; no counter is required. Frequency accuracy is an astonishing ± .1 Hz over all temperature extremes. Multiple tone frequency operation is a snap since the dip switch may be remoted. Our SS-32 encode only model is programmed for all 32 CTCSS tones or all test tones, touch-tones and burst-tones. And, of course, there's no need to mention our 1 day delivery and 1 year warranty.

TS-32 Encoder-Decoder

- Size: 1.25″ x 2.0″ x .40″
- High-pass tone filter included that may be muted
- Meets all new RS-220-A specifications
- Available in all 32 EIA standard CTCSS tones

SS-32 Encoder

- Size: .9″ x 1.3″ x .40″
- Available with either Group A or Group B tones

Frequencies Available:

Group A			
67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

- Frequency accuracy, ± .1 Hz maximum −40°C to +85°C
- Frequencies to 250 Hz available on special order
- Continuous tone

Group B		
TEST-TONES:	TOUCH-TONES:	BURST-TONES:
600	697 1209	1600 1850 2150 2400
1000	770 1336	1650 1900 2200 2450
1500	852 1477	1700 1950 2250 2500
2175	941 1633	1750 2000 2300 2550
2805		1800 2100 2350

- Frequency accuracy, ± 1 Hz maximum −40°C to +85°C
- Tone length approximately 300 ms. May be lengthened, shortened or eliminated by changing value of resistor

Wired and tested: TS-32 **$59.95**, SS-32 **$29.95**

VISA

COMMUNICATIONS SPECIALISTS

426 West Taft Avenue, Orange, California 92667
(800) 854-0547 / California: (714) 998-3021

15

Mark Oman WAØRBR
528 Deines Court
Ft. Collins CO 80525

The Fun-Oscillator

—a simple, goof-proof vfo for your QRP transmitter

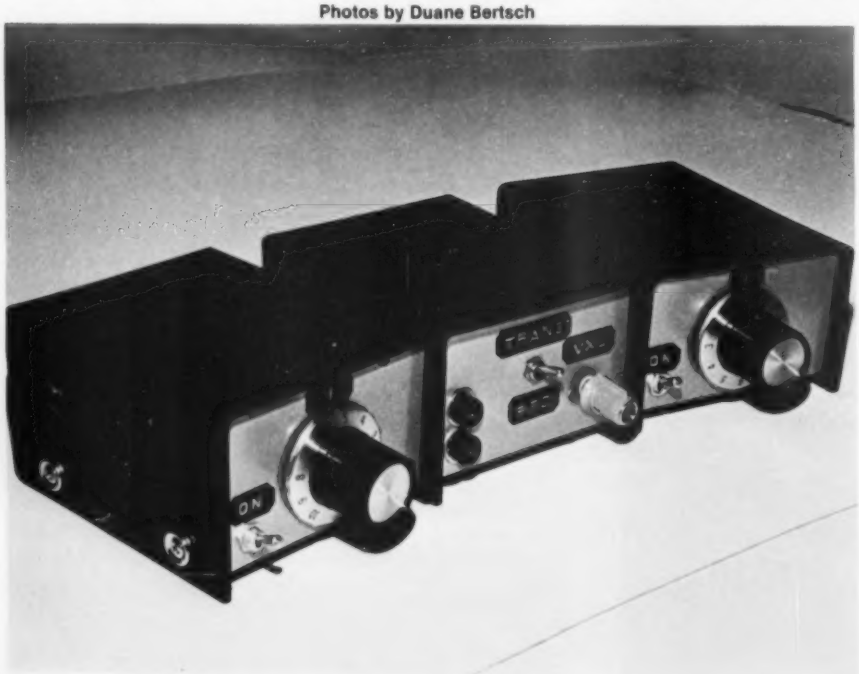
Note: A complete kit of parts, including PC board, is available from RADIOKIT, Box 411S, Greenville NH 03048 for $34.95 plus $2.50 shipping and handling.

The Fun-Mitter (February, 1981, *73*) and Fun-Ceiver (July, 1981, *73*) provided the home-brew-oriented amateur with the basic components for a home-brew station setup.

Many amateurs have responded by saying that they need more frequency flexibility for their Fun-Mitters.

The simple vfo described in this article is the result of those requests. It allows greater frequency excursions than the simple vxo circuit of the Fun-Mitter to provide approximately the same frequency coverage as the companion receiver. The vfo follows the same guidelines as the two previous articles and should be as easy (or easier) to construct and to get operational.

Photos by Duane Bertsch



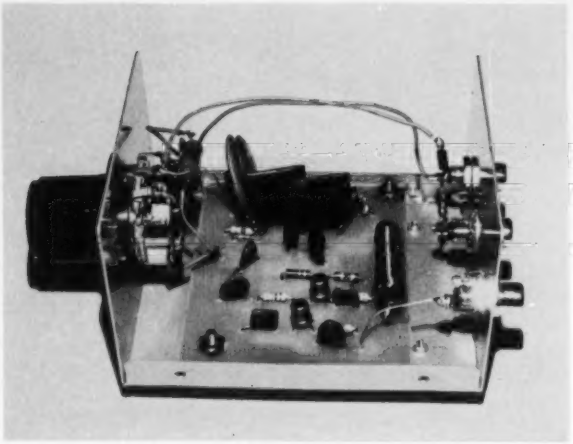
A Fun-Station!

For those unfamiliar with my earlier articles, this series of articles focuses on simple, easy-to-construct, easy-to-operate gear with all parts available from local Radio Shack outlets. Size and appearance of the vfo match the transmitter and receiver to provide a nice looking station package.

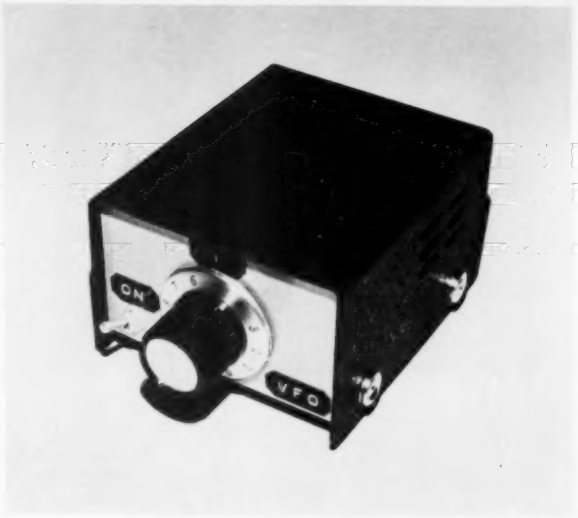
Of utmost importance is the fact that no modifications have to be made to the Fun-Mitter to use the vfo. It simply plugs in where the crystal was (unless C_{opt} was installed). This allows for either crystal or vfo operation of the Fun-Mitter. Also, it can be constructed for either 40 or 80 meters. It provides about 70 kHz of coverage on 40 meters and about 50 kHz on 80.

The Circuit

The vfo should be the most goof-proof of all three pieces of gear as evidenced by the schematic of Fig. 1. The basic frequency-determining portion of the vfo is identical to the vfo of the



Internal view of vfo.



Front view of the completed Variable Fun-Oscillator.

Fun-Ceiver. This allows for ease of understanding and construction as well as similar frequency range.

Before I began this series, I developed a set of guidelines for the items to be designed. Based on this criterion of setting goals in advance, I developed the following goals for the simple vfo.

- Good performance (no chirp, minimal draft, clean waveform)
- Simple construction (PC board use, less than four hours total build time, minimum parts count)
- Cost—less than $20 with new parts
- Minimal modification to the Fun-Mitter
- Full output from the Fun-Mitter
- No variable capacitors or inductors

The final version of the vfo meets the above goals.

Only three transistors are used in the vfo, one as the oscillator (Q1), one as a class-A amplifier (Q2), and one as an emitter-follower buffer (Q3). This final version of the vfo went through three revisions from the original form. This was necessary to maintain good performance while still keeping things simple. The original design included only two transistors, but at times chirp was detected on the transmitted signal. The main advantage of the circuit of Fig. 1 is that only one tuned circuit is used (L1). This means modifying only one inductor!

Q1 operates as a parallel-tuned Colpitts oscillator with L1, CR1, CR2, C1, C2, and C3 being the frequency-determining components. The oscillator is tuned by varying the voltage at the junction of the two diodes. This, in turn, varies the capacitance of the diodes which varies the frequency of the oscillator. L1 is a modified Radio Shack 10-μH rf choke. It is modified, as described later, to provide the needed inductance. The last few turns of the modified choke are spread out over the choke body to provide an easy means of setting the oscillator frequency.

As mentioned in the receiver article, the capacitors needed to build a stable vfo are not easily found at Radio Shack. NPO-type capacitors from a large variety pack again are used in parallel and series combinations to obtain the needed capacitance for C1, C2, and C3. Silver-mica or polystyrene capacitors will give even better results.

Output from Q1 is taken through a coupling capacitor, C4. This capacitor should be kept as small as possible to isolate the oscillator from load variations which can cause chirp. The capacitor is attached to the next stage, Q2, a class-A amplifier. This amplifier raises the level of the signal to the level needed to drive the Fun-Mitter.

Q2 is direct-coupled to the final stage, Q3, an emitter follower. This stage provides excellent isolation between the oscillator and the transmitter as well as providing an impedance match between the two. Without Q3, as in the original design,

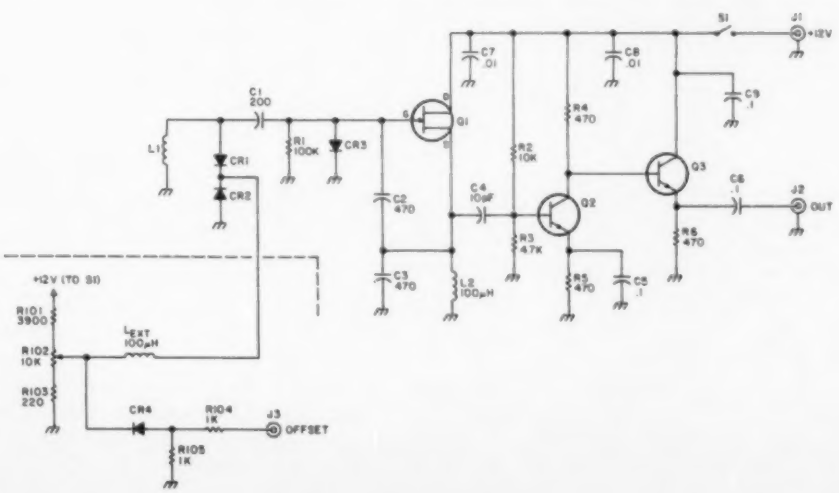
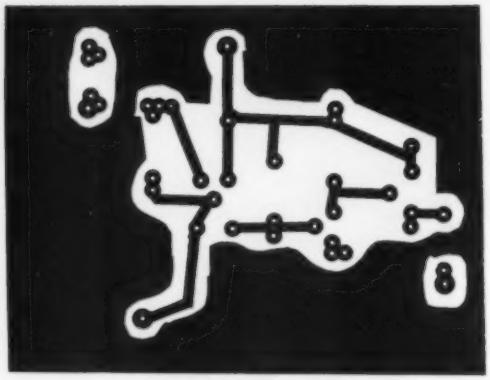
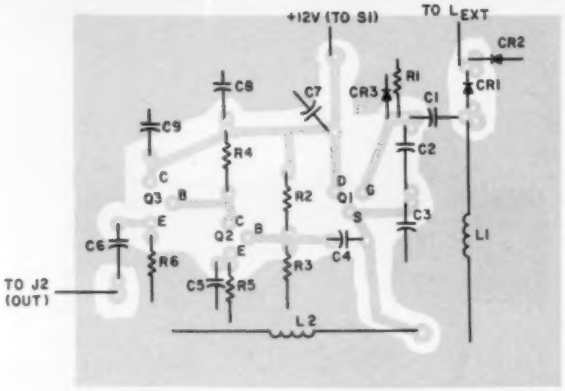


Fig. 1. Schematic of vfo.



PC layout for vfo.



Component location.

PC boards for the vfo are available from the author for $7 ppd. PC boards for the previous articles also are available as follows: Fun-Mitter—$7 ppd; Fun-Ceiver—$7 ppd; Filter—$3.50 ppd.

Parts List

Designator	Value	Radio Shack Part Number
C1	200 pF NPO (approx.)	272-801
C2, C3	470 pF NPO	272-801
C4	10 pF (use two 4.7 in parallel)	2-272-120
C5, C6, C9	0.1 μF	272-135
C7, C8	0.01 μF	272-131
CR1-CR4	1N914 On 80 meters, for CR1 and CR2, use two 1N914s in parallel for each (piggyback)	276-1122
J1-J3	phono jack	274-346
L1	80m: Two 273-101 inductors in series; one with no turns removed, one with 10 turns removed 40m: 10 turns removed from 273-101 inductor. For both 80 and 40 m the last 3 turns of the modified inductor should be spread out over rest of the form	
L2	100-μH inductor	273-102
Q1	FET	276-2035
Q2, Q3	RS2033	276-2033
R1	100k, 1/4-W	271-1347
R2	10k, 1/4-W	271-1335
R3	4.7k, 1/4-W	271-1330
R4-R6	470Ω, 1/4-W	271-1317
Not on PC board:		
L_{ext}	100-μH inductor	273-102
R101	3.9k, 1/4-W	271-1329
R102	10k linear pot	271-1721
R103	220Ω, 1/4-W	271-1313
R104, R105	1k, 1/4-W	271-1321
S1	SPST switch	275-612
case		270-251
knob		274-392

the vfo is not stable when the transmitter is keyed.

CR4 is used to shift the frequency of the vfo when the transmitter is not in use and you are listening to the receiver. It does this by changing the voltage at the junction of CR1 and CR2, which shifts the oscillator frequency. Without this feature, the vfo signal would appear on the listening frequency and make listening impossible!

Construction

The construction of the vfo is intended to be goof-proof. It is built on a 2¼" × 3" single-sided board just as the transmitter and receiver were. It cannot be overemphasized that the circuit should be built on a PC board. Nearly all of the problems that readers had in building the previous two pieces of gear were due to breadboard or point-to-point construction. If you are an inexperienced homebrewer, it is fairly easy to make mistakes when wiring the circuit apart from a printed circuit board.

I built my vfo in an enclosure that matches the enclosures used for both the transmitter and receiver. Also, the front-panel layout was made compatible to enhance the appearance of the gear.

As can be seen in the photographs, the tuning potentiometer (R7) is mounted on the front panel. The associated resistors and inductor (R6, R8, L3) are also mounted on this potentiometer, and wires run from there to the appropriate circuit points.

The rear panel contains three jacks. One is for the vfo output signal, and one is for the vfo offset. The connection between the vfo and transmitter should be made with coaxial cable (RG-174 or RG-58).

Operation

The vfo is best operated with a battery rather than an ac supply. This eliminates any possibility of ac hum on the transmitted signal. It also helps improve frequency stability. Two 6-volt lantern batteries in series will power the vfo for a long period of time. If the Fun-Mitter is powered by batteries, the needed 12 volts can be tapped from those batteries.

Tuning and operation are very easy: Only one adjustment needs to be made—setting the vfo on frequency. This is accomplished in the same manner as was done in the receiver. Using a separate receiver, listen on the frequency you want the low end of the vfo to be set on (for example, 7100 kHz). Drape a length of wire near the vfo and attach the other end to the receiver

antenna input. With the vfo on and warmed up, slowly spread or compress the last few turns of L1 until the vfo signal is heard in the receiver. This adjustment should be done with the tuning potentiometer (R7) fully counterclockwise. Finally, verify that the vfo covers approximately 70 kHz if built for 40 meters and 50 kHz if built for 80. That's all there is to the adjustment.

To operate the vfo, two connections need to be made—one to the transmitter crystal socket and one from the vfo offset input to J3 of the Fun-Mitter. (This jack was added to provide receiver mute operation for the Fun-Ceiver.)

If C_{opt} was not included in the Fun-Mitter, then the vfo signal can be applied directly to the crystal socket terminals (see Fig. 2). If C_{opt} was included, remove its connection and connect that terminal of the crystal socket to ground. An inspection of the Fun-Mitter schematic will reveal that even this step is not necessary if a method can be derived to connect the shield of the vfo cable to ground of the Fun-Mitter. Alternatives such as a rear-panel phono connector on the Fun-Mitter also can be used. A plug can be made easily from two ½" to ¾" lengths of #12 gauge copper wire. Solder the vfo signal and ground leads to these wires and plug them into the appropriate crystal socket pins.

Once the vfo is plugged in and turned on, verify that the transmitter operates as it did before. With the vfo in use and all connections in place, the vfo signal should be heard only when the transmitter is in the transmit mode (due to the vfo offset feature). Zero-beat the vfo with the transmitter in the transmit position and the key down. Remember that when using a direct-conversion receiver, you must zero-beat the correct side of the signal you are listening to.

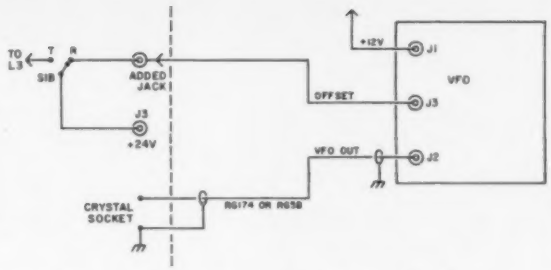


Fig. 2. Connections between vfo and Fun-Mitter.

Crystal operation still can be used by simply removing the vfo leads and plugging the crystal back in.

It should be possible to use the vfo with low-power solid-state transmitters other than the Fun-Mitter. However, modifications may be necessary to the transmitter if the oscillator is not configured as in the Fun-Mitter.

Conclusion

The vfo should be simple to build and goof-proof in its operation. Many more contacts now should be possible due to the ability to move to the frequency the other station is on. This series will be continuing in the months to come with additional goof-proof projects. Meanwhile, enjoy the Variable Fun Oscillator! ■

THE RTTY ANSWER

THINKING OF RTTY??
APPLE ... TRS ... HEATH ... DEDICATED SYSTEM? SOFTWARE? INTERFACE? PERFORMANCE? PRICE? We know you have questions ... check our answers. Call today for information on our terminal units!

IRL
700 TAYLOR RD.
COLUMBUS, OHIO 43230
(614) 864-2464
VISA OR MASTER CHARGE ACCEPTED
IMMEDIATE DELIVERY

Build this Antennalyzer

—you'll need a weekend

Photos by W1GSL

Penn Clower W1BC
459 Lowell Street
Andover MA 01810

Photo A. Front view of the dummy load/wattmeter/rf bridge. The resistance dial is a 2-1/4" diameter plastic skirt attached to a standard knob.

Here is a weekend project that combines two instruments and an old technique into a very handy gadget to have around the shack. First, it's an 8-to-10 Watt 52-Ohm dummy load with a calibrated wattmeter: perfect for tuning up low-power transmitters. Second, it's also a calibrated rf resistance bridge which can make antenna adjustments a lot easier by telling you more about the nature of a mismatch than a plain swr bridge will. The old technique provides a nice tie-in between these two instruments and gives some benefits besides: The dummy load is also a resistive power divider that provides a low-level driving signal for the rf bridge.

One benefit of this arrangement is that the power source sees a load which is essentially independent of the bridge load. That means you can load your QRP transmitter into this instrument, put that new antenna on the bridge output, and fool around to your heart's content without risk of damaging the transmitter or even detuning its output stage. In addition, the power delivered to a 50-Ohm load is only about 40 mW when the power coming out of the transmitter is 5 Watts. That is a 21 dB reduction, and it means that any signal you radiate while adjusting the antenna is 3-1/2 S-units less than it might have been—certainly a neighborly gesture on today's crowded bands.

Background Theory and Circuit Description

There is nothing new or unique about the circuits described here. Rf resistance bridges have been around longer than the more familiar high-power swr bridges and there are several examples in recent publications.[1,2] The dummy load/power divider technique was described in *Solid State Design for the*

CT2100

HAL Puts MORE Behind The Buttons

Four Internal RTTY Demodulators
- High Tones (U.S. Standard)
- Low Tones (IARU Standard)
- 103 Modem (1070/1270 HZ)
- 202 Modem (1200/2200 HZ)

Auto Mark-Hold

All 3 RTTY Shifts (High or Low Tones)

LED Tuning Indicators
-Plus-
On-Screen Tuning Bar
-Plus-
Ext. Scope Connections

Audio or RS232 Data

Input Audio From Receiver or Tape

Transmit and Receive With RTTY Loop Devices

Audio Monitor For Either Input or Output Signals Internal Speaker Plus External Output

CT2100 System:

- CT2100 Communications Terminal
- KB2100 Keyboard
- Video Monitor
- Printer (300Bd Serial ASCII-MPI-88G)
- RM2100 Rack Adapter
- MSG2100 2000 Character "Brag Tape" ROM

- 24 Line Display
- 2 Pages of 72 Character Lines
  -or-
  4 Pages of 36 Character Lines
- Split Screen (with KB2100)

345

HAL COMMUNICATIONS CORP.
Box 365
Urbana, Illinois 61801
217-367-7373

Radio Amateur (ARRL) and recently used in a transmatch tuning circuit described in *QST*.[3]

What I hope to emphasize here is this instrument's usefulness as a matching aid, the simple and inexpensive nature of the circuit, and the fact that the same circuit can be used as a dummy load with a built-in calibrated wattmeter. It's like getting two instruments for the price of one, and the final result is a very handy piece of test gear.

The resistive rf bridge is a simple modification of the classic low-power swr bridge, so before getting down to circuit details let's consider swr bridges in general for a moment. There are two main types of bridges used for measuring swr, and the most common type is a high-power handling circuit meant to be left in the transmission line for continuous monitoring. Usually, this type of bridge requires a minimum of 5 Watts or so driving the load before the meter readings are large enough to interpret accurately. This occurs because the bridge itself is very loosely coupled to the transmission line, typically through a few picofarads or several inches of wire running parallel to the center conductor of the main line.

The other type of bridge is inherently a low-power instrument. The driving signal runs right through the resistive elements which make up the bridge, so the bridge itself must be able to absorb a large fraction of the input power. The resistive bridge doesn't find much use in amateur circles because it requires only a Watt or less of drive and can't be left permanently in the line; it's strictly an occasional-use test instrument.

There is nothing wrong with continuous swr monitoring. After all, the familiar deflections of the high-power monitor do give a constant verification that the transmitter is tuned and the antenna connected. The low-power test instrument described here has some advantages over the usual swr bridge, though, especially for initial antenna adjustments, because it tells you more than just the magnitude of a mismatch.

Swr can be defined several ways, and one is the ratio of a load impedance to the transmission line's characteristic impedance (which is almost always near 50 Ohms in current amateur usage). For example, to cause a 3:1 swr, a 50-Ohm cable could be terminated with either 150 or 16.6 Ohms. These are purely resistive loads, but there is also an infinite number of reactive loads which would give the same 3:1 swr, and a common swr bridge can't tell the difference between any of them. You can build a bridge to measure both the reactance and resistance present in a load,[4,5,6] but such bridges tend to be too complex for my taste and requirements.

When matching a load to a 50-Ohm line, I generally have two questions. Is it resonant, and what's its resistance? If a load is resonant (and that's how I want all my antennas to be), then it has no reactive component—just resistance. If I know the value of that resistance, then I know the swr and whether I need more or less resistance to get a match. I'll give an example at the end of the article, but right now let's look at the schematic shown in Fig. 1.

There really isn't much to the circuit diagram. The input signal is terminated in a 53-Ohm dummy load constructed with a series-parallel resistor assortment. The voltage development across the 10-Ohm portion of that dummy load drives a simple bridge circuit made up from a 250-Ohm pot, a 51-Ohm standard resistor, and the load impedance. The bridge error signal appears between the output connector and the potentiometer arm and is detected by a germanium diode. The result is then indicated by a 100-uA meter in a voltmeter circuit.

Bridge operation is equally straightforward. When input power is applied to the instrument, it develops a voltage across the 53-Ohm dummy load. About 1/5 of this voltage appears across the 10-Ohm portion of the dummy, and this is the driving voltage for the resistance bridge. Some fraction of this driving voltage shows up between the potentiometer arm and ground, the exact amount depending, of course, on the shaft position. Similarly, there is some other fraction of the bridge driving voltage appearing across the load terminal, this fraction depending on the load resistance connected there.

If there is no load connected, then the entire source voltage appears there and we'll make use of that fact later to calibrate the wattmeter portion of this instrument. If a 51-Ohm load is connected, then exactly half the source voltage will be there. The difference between the output voltage and the potentiometer arm voltage is rectified by the diode and drives the meter through the sensitivity control, so with the 51-Ohm load the bridge will show a null when the pot travel is exactly centered. Other load resistances will show nulls at other positions and the potentiometer dial may be calibrated by marking the nulls corresponding to a whole series of load resistances. In theory, the bridge should show nulls for every load resistance between zero and infinity, but in practice this doesn't happen because the potentiometer isn't infinitely adjustable.

The circuit can be calibrated pretty accurately for resistances between 5 Ohms and 1k, with the best resolution around the center of the dial at 20 to 150 Ohms. Notice that the bridge cannot be nulled completely if the load has a capacitive or inductive component since such a load would introduce a phase shift between the bridge source voltage and the bridge load voltage. As there is no corresponding phase shift between the bridge source voltage and the potentiometer arm voltage, there never will be a point where the diode voltage will be zero and the meter nulled. Even when the voltages at each end of the diode are equal in amplitude, the fact that they are phase-shifted with respect to each other guarantees that there will be a sine wave or error voltage for the diode to rectify. In practice this means that unless the load is a pure resistance there will not be a true null but only a partial dip in the meter reading as the potentiometer shaft is turned.

A true rf impedance bridge would have two null adjustments: one for rf resistance and one for reactance. With such a bridge you can completely define any mismatch, but, as noted earlier, that's often unnecessary, especially in antenna work where the goal is to tune out reactance by resonating the antenna. You can always tell when a load is resonant with the resistance bridge because at resonance the null will be complete. Then steps can be taken if necessary to transform the remaining impedance to match a 50-Ohm line.

Reader Service for facing page ⌐81¬

KDK MAKES 2 METER FM SIMPLE AND EASY!

KDK

KDK INTRODUCES A NEW GENERATION OF 2 METER FM RADIOS.
The sparkling 2025A MKII is loaded with new features! Ease of operation is the design concept at KDK.

SPECIAL! WINTER SALE! $299

Includes:
Touch Tone® Mike (Ready to Use)
ORDER NOW DIRECT

- Features such as ten channel memory in two banks of five each, a solid 25 watts of power, full MARS and CAP coverage from 143,000 Mhz to 148.995 Mhz, plus built in memory retention for up to one year . . . and much, much more makes this the radio of the year. If you have been waiting to move up to a new model, or have wished for a radio with "everything" . . . KDK has it!
- The ten channel memory is easily addressable and you have two banks of five channels each. You can even use both banks at once for odd splits.
- Standard 600 hz shift up or down. Band scan or memory scan. Memory scan is easy. There is also band scan with upper and lower limits you can choose yourself!
- Built in nicads for the memory retention which has drain in nano-amps, not milli-amps. The internal battery will hold the memory for up to one year! No other radio offers you this feature.
- Fast and easy dialing. Full solid state dialing and you can choose from the front panel either a fast or slow dial rate.
- No relays are used, only solid state switching. This eliminates a trouble spot many radios encounter.
- KDK has also eliminated another trouble spot by completely hand wiring each radio. No internal plugs to become intermittant and no wire wraps either, just good solid wiring.
- KDK gives you one of the hottest receivers you can find. By using UHF (not VHF) dual gate MOS-FETs with electronic auto tuning for the RF amplifier and the first mixer, you have a combination of ultra sensitivity and maximum quietness.
- The audio output stage in the 2025A Mk II uses an integrated circuit which has internal protection against over-voltage and shorted output conditions. Plus it is a high audio output chip – just what you need in a noisy mobile situation.
- The transmitter uses direct VCO varicap modulation for true FM. Your transmitted audio sounds as it should; crisp, clear and natural.
- The power output stage of the 2025A Mk II will not break down even with an infinite VSWR load, and uses heavy duty solid state antenna switching with a four stage low pass filter. All this gives you an exceptionally clean, spur free output.
- KDK has included an adjustable sub audible tone circuit which can also be used for CTCSS or tone burst on transmit. Again, more features!
- Size is 2 7/10" high – 7 1/8" wide – 9 1/2" deep.
- You can switch from 25 watts to 3 watts low power.
- And, of course, the DC cable is included along with the microphone and mobile mounting bracket.

ORDER NOW DIRECT
CALL TOLL FREE
800-251-4141

This number for ORDERS ONLY!
Mail Order – COD – Bank Cards

VISA MasterCard

HOURS – 9:00 - 5:00 CST Monday - Saturday
Phone (615) 865-7949
Telex 80-8327

Write for brochure – Dealer inquiries invited!
Warranty Information available at your dealer
Company reserves the right to change specifications without notice.

Exclusive US Distributor – Dealers Welcome!

ORDER DIRECT
OR AT YOUR DEALER!

KDK

Distributed by:

KDK DISTRIBUTING CO., INC.

617 SOUTH GALLATIN ROAD – MADISON, TN 37115
Phone (615) 865-7949

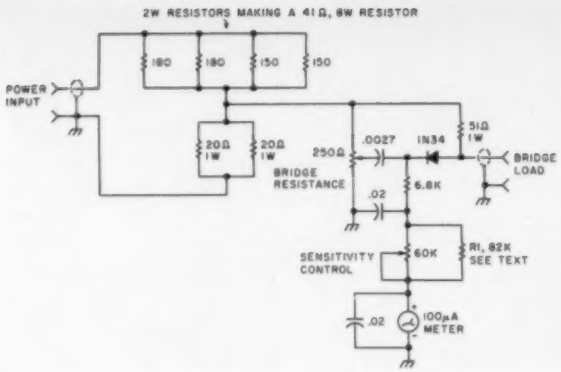


Fig. 1. Schematic diagram of dummy load/wattmeter/rf bridge. R1 is chosen as necessary to calibrate the wattmeter.

This same bridge circuit can be used to measure the power delivered to the dummy load by the transmitter. A glance at the schematic will assure you that with no load connected to the bridge and the resistance dial set to zero Ohms, the voltmeter circuit will indicate the rf voltage across the 10-Ohm portion of the dummy load. Knowing that voltage, we can easily calculate the voltage across the whole dummy resistance, and knowing that, we can calculate the power there from $P=V^2/R$. The calibration can be accomplished using only a dc voltmeter and will be described shortly.

Construction

A lot of articles begin their construction description with the assurance that "the layout is completely noncritical." That is certainly not true here, but "critical" is also too strong of a word, so let me just caution you to be careful with layout. There are three main areas that can cause trouble.

First, it's best to arrange the dummy load portion of the circuit so that current flowing in the ground path from the bottom of the dummy load back to the input terminal does not share any conductor with part of the bridge circuit. If it does, then variations in the input power will shift the null positions on the resistance dial. Photo B shows one way to solve that problem by bringing the input power and its ground return to the dummy resistors on a single piece of coax, thus avoiding the temptation to ground the bottom resistors to some point on the chassis.

Second, the detector diode should have one end connected directly to the output jack. My first few attempts had more compact physical arrangements with the diode connected to the bridge output terminal with lengths of wire or brass strips. This always interfered with getting good deep nulls on both ends of the resistance range.

Third, the detector should not be a silicon diode, since the 0.6-volt threshold of a silicon diode will cause the bridge nulls to be too wide. With a given load termination there should be a single, sharp deep null on the dial, not a dead zone covering several degrees of rotation. My collection of diodes is pretty large, and the best of the lot turned out to be some germanium 1N34 equivalents I paid 10¢ each for some 15 years ago! Radio Shack's 276-1123 diodes cost the same today and should work as well.

The dummy load nominal value is about 51 Ohms with the circuit shown. I used an assortment of resistors from the junk box, so feel free to substitute values, but do observe a few simple rules. Wire-wound resistors are definitely out because they look like coils at radio frequencies. Also, stick with carbon resistors having values less than 1k. When paralleling resistors, try to have them all of the same value so they dissipate equal amounts of power. Keep the leads short and the wiring direct; this keeps the dummy load looking resistive at the higher frequencies and prevents stray coupling which might interfere with the bridge nulls.

The rest of the physical arrangement is pretty clear from the photographs with the exception of the bridge potentiometer mounting. A similar bridge is described in W6SAI's 1962 *Radio Handbook*[7] and the author there cautions that stray capacitive coupling between the potentiometer resistive element and ground can cause frequency sensitive errors in calibration.

The suggestion made there, and followed here, is to cut a large hole in the box (say, 1-1/2" in diameter) and mount the pot in the center of this open space using a piece of insulating plastic, bakelite sheet, or unplated circuit board for support. This insulates the pot body from ground and thereby greatly reduces the capacitive coupling between the pot resistive element and ground. It seemed like a good suggestion so I followed it. I can't strictly say it is necessary because I didn't try it the other way, but it sure can't hurt.

The skirt on the resistance dial covers the hole from the front of the box. If you want to use a smaller knob with a pointer, you could mount a rectangle of insulation over the hole from the front side of the panel and use that to hold the pot and the calibration marks. The actual value of the bridge potentiometer is not too critical. It should be at least 50-Ohms so that it doesn't draw too much power, and anything over 1k is probably asking for trouble with stray capacitance. If you have anything inside that range, try it before you buy a new 250-Ohm unit.

The box shown is a cut-down Bud minibox that started out as 3"×4"×5". The 3" height was reduced to just under 2" because it fit the hand better, but there is nothing magic about these dimensions. Use anything of roughly the same size as long as it is made of metal. You also will note in the photographs that BNC connectors are used instead of the more common (in amateur circles, anyway) UHF series. I don't run enough power to require RG-8, and I find the smaller quick-connect BNC connectors more convenient for my home-brew projects. Naturally, if all of your antenna cables have UHF connectors, then you also should use them on your bridge.

Calibration

There are two things to calibrate here: the wattmeter and the bridge scale. The meter serves as a null indicator when using the bridge, so the wattmeter calibration can be done after the bridge has been checked out.

The bridge dial can be as simple or fancy as desired but it should be large enough to read easily. The skirt on my dial is 2-1/4" in diameter. You probably will want to start with a paper scale and save the fancy artwork until everything is working properly.

Assemble a collection of carbon resistors covering as

many values as possible between 5 and 1000 Ohms and then cut the leads to about 1" in length. The leads are bent so the resistors can be spring loaded into contact with the bridge output connector. If you have a lot of spare connectors, you also could make up a number of dummy loads with the different resistors similar to the one shown next to the bridge in Photo B.

Any layout problems will be more pronounced at the higher frequencies, so fire up a 10-meter rig if you have one and feed several Watts of rf into the bridge. (I've used this instrument only on 10 meters, but it might work all right up to 6 meters.) With the bridge excited, check the nulls at both ends of the range, say, with a 10-Ohm then a 680-Ohm load.

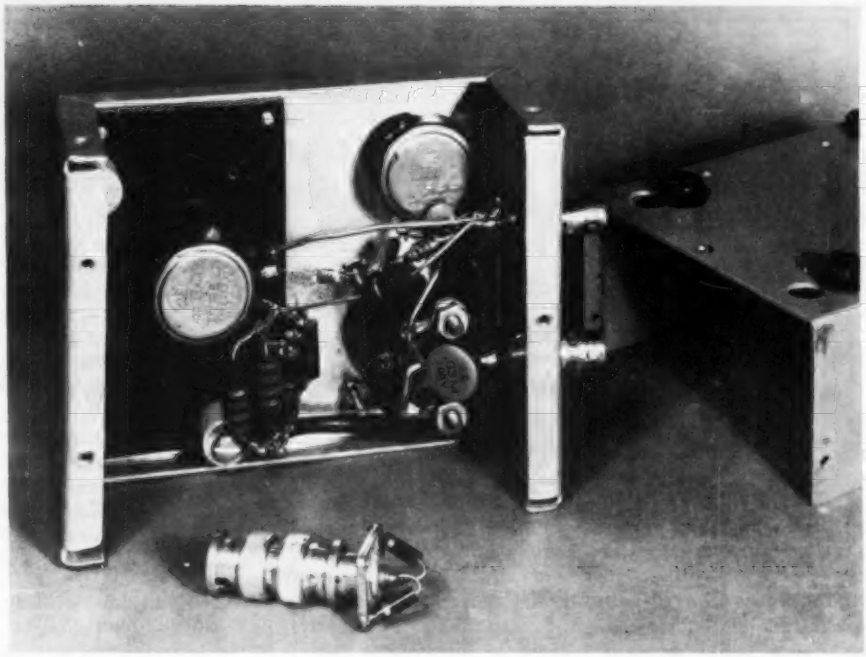


Photo B. Interior of the instrument, showing layout and construction details. The object in the foreground is a dummy load typical of those used during calibration.

Both nulls should be deep and well defined. If one isn't as deep as the other, then there is probably something wrong with the physical layout of the bridge elements. Try moving things around some or try another ground routing. If you followed the layout shown, then there really shouldn't be any trouble. Remember that this is an rf resistance bridge and with resistors on the bridge output, the nulls theoretically should be right down to zero meter movement. In practice, stray reactances prevent the nulls from being perfect but they should come pretty close to it. If the load does contain some reactance, there still will be a dip but it won't be to zero as previously mentioned.

When you're satisfied with the basic bridge operation, make a temporary scale and mark off the positions of the nulls due to the collection of sample resistors. Standard resistor values aren't nice round numbers, but with enough calibration marks you can make a final scale with lines at 5, 10, 20, 30, etc., Ohms as shown on the front panel in Photo A.

The wattmeter scale can be calibrated easily using a dc power supply and a good dc voltmeter. Remember that the wattmeter is actually reading the rf voltage across the 10-Ohm portion of the dummy load when there is no bridge load and the bridge pot is set to zero Ohms. Under these conditions, the 0.0027-uF coupling capacitor (that's not a critical value—anything from 0.001 to 0.05 will work as well) will charge to the peak value of the rf sine wave.

Since the peak value of a sine wave is 1.414 times the rms value, it is easy to calculate a dc value which, when fed into the instrument, will read the same on the meter as some given rf power. A conversion chart for the 53-Ohm dummy load is given in Table 1 along with the equation necessary to calculate your own equivalents should you use some other combination of resistors. Since I was interested in converting CB sets, I calibrated my wattmeter for a full-scale reading of 5 Watts, even though the resistors can handle 10 Watts for short periods. To make the 5-Watt calibration, feed a measured 22.9 volts into the unit, turn the sensitivity control all the way down (maximum resistance), and select a value for R1 that gives a full-scale meter reading.

Now comes the hardest part: making the meter face. I don't like conversion charts so I made a whole new face for my meter. It's not as difficult as you might think, but it does require a steady pair of hands.

Open the meter, remove the two screws holding the faceplate in place, and remove the faceplate while taking care not to damage the meter pointer. Glue a clean piece of white paper over the old faceplate using paper paste and not liquid white glue (which tends to dampen the paper so much that it wrinkles). Be sure to cover the faceplate evenly with paste so the paper won't have a chance to wrinkle. The pointer travels close enough to the faceplate that it can get stuck on wrinkles.

When the paste is dry, use a sharp knife to trim off the excess paper, and a pin to punch through the screw holes. Now a drawing set with an ink compass can be used to draw in a nice arc for the baseline of the new scale. Remount the faceplate, center the meter zero adjustment, and make a light pencil mark under the pointer tip to define the zero rest position. Reapply the 22.9 volts and make another pencil mark to spot the 5-Watt full-scale position. Now go down the list in Table 1 and mark off each intermediate point, checking occasionally that all of the points are repeatable and properly marked.

Finally, remove the faceplate again and finish off the scale graduations with

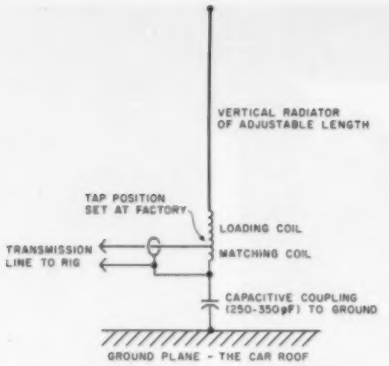


Fig. 2. Shortened loaded vertical, a CB mag-mount whip.

ink or dry transfers using the light pencil marks as a guide. With a little care, the results can be pretty professional. One real bonus of this technique is that the calibration is correct with the particular diode, resistors, and meter actually used, since the whole circuit is calibrated at once. That's important because the diode is not a perfect rectifier and the meter scale will be influenced slightly by the characteristics of the particular diode used.

An Application Example

The most obvious use for

Input Power Watts	Dc Voltage Equivalent
5.0	22.90
4.0	20.49
3.0	17.74
2.0	14.49
1.0	10.24
0.5	7.24
0.4	6.48
0.3	5.61
0.2	4.58
0.1	3.24

Table 1. Wattmeter calibration. Input power levels corresponding to dc voltage equivalents. Values are calculated using $E = \sqrt{2RP}$, *where P = rf power (in Watts), R = total dummy resistance, and E = dc input voltage (where E is peak value of rf sinewave). Caution: With these dc inputs, the dummy load is dissipating twice the indicated rf power, so be careful not to overheat the resistors.*

the rf resistance bridge is in making matching adjustments to antennas. Some antennas, dipoles, for example, are easy to adjust with an swr bridge since their feedpoint impedance at resonance is already close to the typical cable impedance. When a dipole is fed with either 52- or 73-Ohm coax, its swr at resonance is bound to drop to somthing like 1.5:1. This isn't true with shortened antennas such as mobile whips since their feed impedance may be only a few Ohms.

There are two adjustments necessary to get a low swr with such an antenna: one for resonance and one for impedance matching. Making these two adjustments with only an swr bridge can be very difficult because a low swr will result only when both settings are correct. With a resistance bridge, the adjustment is much easier.

Consider the antenna shown in Fig. 2, a magnetically-mounted, base-loaded CB whip. The antenna really has two adjustment points, although the tapped loading coil is normally adjusted and sealed at the factory and all that is necessary for 27-MHz operation is a slight height adjustment. Putting this antenna to use on 10 meters or using a different length whip section may change things enough that a low swr cannot be achieved without a change to the coil size or tap position.

For example, I am using one of these antennas on the roof of my house as a loaded ground plane. The eight 1/4λ radials laid out on the roof do not provide the same type of ground return as the roof of an automobile. In addition, a 5' whip is being used as a radiating element in place of the original 3' length. This longer length lets me use a smaller loading coil with lower losses. I built this test instrument partly because of the difficulty I was having trying to tune this antenna with only an swr meter and grid dipper.

Adjusting such an antenna is a lot simpler with the rf resistance bridge, but first the bridge must somehow be connected to the base of the antenna. It would be nice to locate the bridge physically at the base of the antenna but this isn't always practical. For one thing, the bulk of the operator's body would probably upset the antenna tuning. If the bridge is connected to the antenna through a length of coaxial cable then that cable length must be chosen carefully because the impedance seen looking into a transmission line depends on three things: the line impedance, the load impedance, and the line length.

Luckily, it happens that a section of transmission line which is some multiple of a half wavelength in length will have an input impedance almost exactly equal to its load impedance. Using such a line makes it possible for the bridge to be located at some convenient position and still indicate the antenna base impedance. At 28.5 MHz, a half wavelength in free space is 16' 5" and in coaxial cable it will be about 2/3 of that or 10' 11".

If you have a section of cable this length, it is easy to check its electrical length with the bridge. First put a 10-Ohm resistor directly on the bridge and check for the null at 10 Ohms. Then insert the cable section between the bridge and resistor and see that the bridge still reads a resistive 10 Ohms. If it is a little off, as indicated by an incomplete null somewhere near 10 Ohms on the dial, you may want to change the transmitter frequency a bit to adjust the operating wavelength to the line's physical length.

Just for fun, you might try a quarter wavelength of cable and verify that it transforms the 10 Ohms into 270 (52-Ohm cable). In fact, you might get out a good article on transmission-line matching sections and try a number of things with different loads and line lengths—it's fun and really brings that dry old theory to life.

With the antenna fed through some multiple of a half wavelength of cable, the radiator length can be adjusted for resonance as indicated by a complete null of the meter reading. The resistance indicated at resonance is the feedpoint impedance of the antenna, and the ratio of that impedance to 52 Ohms is the swr on the cable—assuming you're using 52-Ohm cable. If the swr is more than 2:1 (antenna impedance greater than 100 or less than 25 Ohms), then you may want to change the coil tap position. It probably is easier to change the inductance below the tap by squeezing or separating the coil turns there slightly than it is to unsolder and move the tap itself. These adjustments can be pretty fine and you probably won't end up changing the coil size by a whole turn's worth anyway.

With the inductance changed, look for the new null on the bridge and, once again, adjust the antenna

height until the feedpoint impedance is pure resistance. Depending on whether that resistance is closer or further from the 52-Ohm target, you now know in what direction the coil must be altered to effect an acceptable match.

Conclusion

Of course, there are many other tuning applications for this instrument besides CB antenna conversions. You will find it more useful than an swr bridge for any application which requires both resonating a load and transforming its impedance. As a bonus, you can use it to measure swr when the load impedance is mostly resistive. The internal dummy load lets you adjust and modify antennas without danger to your transmitter and without putting a big signal on the air. You'll also find that the dummy load and calibrated wattmeter are a valuable QRP tune-up aid. Last, but not least, you can develop a real understanding of transmission-line matching techniques by using the bridge to verify some of the theory you read when studying for your ticket! ■

References

1. C. Klinet WB6BIH, "Home-Brew Rf Impedance Bridge," *73*, May, 1980.
2. J. Sevick, "Simple Rf Bridges," *QST*, April, 1975.
3. W. Vissers, "Tune-up Swiftly, Silently, and Safely," *QST*, December, 1979.
4. R. Luetzow, "Build an Operating Impedance Bridge," *QST*, November, 1979.
5. R. Hubbs and F. Doting, "Improvements to the RX Noise Bridge," *Ham Radio*, February, 1977.
6. J. Hall and J. Kaufmann, "The Macro-Matcher," *QST*, January, 1972.
7. W. Orr, editor, *The Radio Handbook*, Editors and Engineers, Ltd., 1962.

Iowa's Only Icom Dealer

ICOM

G&K Amateur Supply
2920 East 9th St.
Des Moines, Iowa 50316

7:00—5:00 Mon-Fri.
7:00—1:00 Sat.

Leroy WD0CZO

101

MBA READER™, A NAME YOU SHOULD KNOW

What does MBA mean? It stands for Morse-Baudot and ASCII. **What does the MBA Reader do?** The RO model (reader only) uses a 32 character alphanumeric vacuum fluorescent display and takes cw or tty audio from a receiver or tape recorder and visually presents it on the display.

The copy moves from right to left across the screen, much like the Times Square reader board. **Is the AEA model MBA Reader different from other readers?** It certainly is! It is the first to give the user 32 characters of copy (without a CRT), up to five words at one time. It can copy cw up to 99 wpm and Baudot at 60-67-75 and 100 wpm. Speeds in the ASCII mode are 110 and hand typed 300 baud. The expanded display allows easy copy even during high speed reception.

The AEA model MBA has an exclusive automatic speed tracking feature. If you are copying a signal at 3-5 wpm and tune to a new signal at 90 wpm, the MBA catches the increased speed without loss of copy.

The MBA Reader allows a visual display of your fist and improves your code proficiency. It is compact in size, and has an easily read vacuum fluorescent display.

The Reader operates from an external 12 VDC source. This allows for portable/mobile or fixed operation.

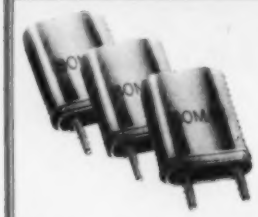
Check the AEA model MBA Reader at your favorite dealer and see all the features in this new equipment. If your dealer cannot supply you, contact
Advanced Electronic Applications, Inc.
P.O. Box 2160, Lynnwood, WA 98036 Call 206/775-7373

AEA Brings you the Breakthrough!

Prices and specifications subject to change without notice or obligation

2

See List of Advertisers on page 114



WE'RE ROLIN IN CRYSTALS!

↙415

2 Meter Crystals — $3.95 each
(10 or More — $3.50 each)
Quick Delivery

We Stock Crystals For:

Clegg	Drake	Icom
Kenwood	Midland	Regency
Standard	Wilson	Yaesu
Lafayette	Tempo	VHF Eng

(Custom Crystal Orders Accepted.)

Rolin Distributors
P.O. Box 436 Department 7
Dunellen, N.J. 08812
201-469-1219

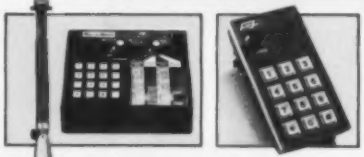
Precision Cut Land Mobiles Available

QRZ W1's, W2's and W3's...

LOOKING FOR AEA PRODUCTS IN THE NORTHEAST?

LOOK TO RADIOS UNLIMITED... NEW JERSEY'S FASTEST GROWING HAM STORE!

Get your hands on AEA's great keyers and Isopole antennas at Radios Unlimited. You can reach us easily via the Jersey Turnpike, and when you get here you can TRY BEFORE YOU BUY at our in-store operating position. Yes! Pick out any AEA keyer, (or any other equipment from our huge stock of ham gear), and try before you buy! We don't mean a little off-the-air diddling with the keyer...we let you PUT IT ON THE AIR AND HAVE A QSO...really check it out under YOUR kind of operating conditions... then decide. We know AEA, and we know you'll select one of these:



CK-1 Contest Keyer with 500 character memory, soft message partitioning, automatic serial number, and much, much more. *call for super-low price!*

MK-1 Morse Keyer with selectable dot & dash memory, full weighting, calibrated speed, bug mode and more. . . . . *call for super-low price!*

KT-1 Keyer Trainer with all the features of the MK-1 above and the MT-1 below. . . . . *call for super-low price!*

MT-1 Morse Trainer for pulling up that code speed the easy way with automatic speed increase, five letter or random word length and more, more, more. . . . . *call for super-low price!*

MM-1 MorseMatic™ memory keyer with two micorcomputers and 37 fantastic features including up to 2000 characters of memory plus virtually every capability of all the other keyers & trainers listed below. . . . *call for super-low price!*

PLUS THE EXCITING ISOPOLES THAT ARE BOOMING OUT THOSE INCREDIBLE VHF SIGNALS WITH MAXIMUM GAIN ATTAINABLE, ZERO DEGREE RADIATION ANGLE AND 1.4:1 SWR ACROSS THE ENTIRE BAND!

Isopole 144	call for
Isopole 220	super-low
Isopole 144 junior	price!
Isopole 220 junior	

Find them all at Radios Unlimited, plus a huge collection of new gear from all major manufacturers...a big selection of used equipment bargains, all you'll ever need in books, accessories, operating aids, coax, connectors and parts plus a modern service department dedicated to keeping you on the air. It's like a perpetual flea market! For directions, call (201) 469-4599.

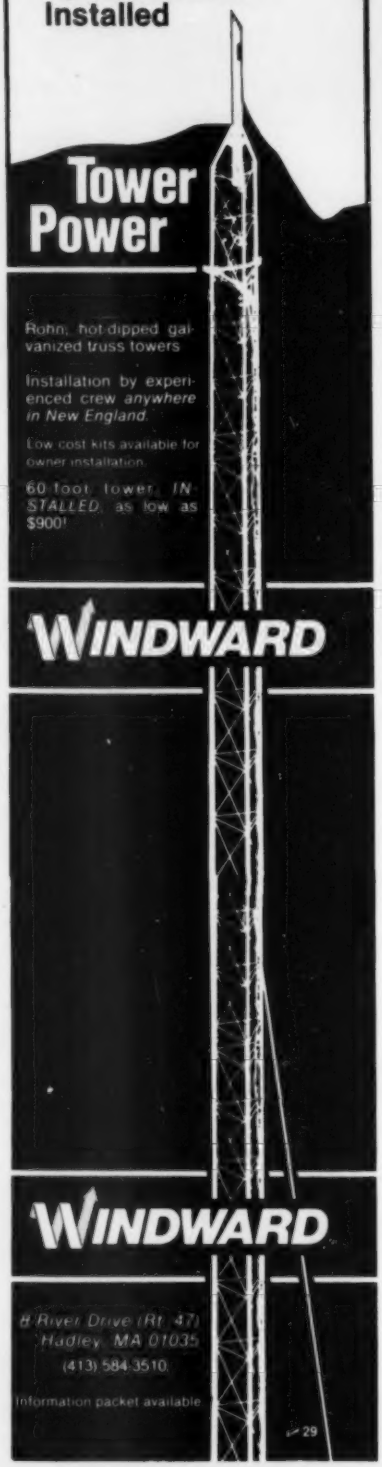
FIND AEA AT

RADIOS UNLIMITED

1760 EASTON AVENUE, SOMERSET, NJ 08873 • (201) 469-4599

TOWERS

Up to 200 foot Installed



Tower Power

Rohn, hot-dipped galvanized truss towers

Installation by experienced crew *anywhere in New England*

Low cost kits available for owner installation

60 foot tower, *INSTALLED*, as low as $900!

WINDWARD

WINDWARD

8 River Drive (Rt. 47)
Hadley, MA 01035
(413) 584-3510

Information packet available

↙29

Reader Service for facing page ↙5→

New! AZDEN® PCS 3000

BLAZING THE FRONTIER OF MICROCOMPUTER COMMUNICATIONS

SUPERIOR COMMERCIAL GRADE 2-METER FM TRANSCEIVER

FREE! TOUCH-TONE® PAD KIT INCLUDED

COMPARE THESE FEATURES WITH ANY UNIT AT ANY PRICE

- **8 MHZ FREQUENCY COVERAGE, INCLUDING CAP/MARS BUILT IN:** Receive and transmit 142.000 to 149.995 MHz in selectable steps of 5 or 10 kHz. COMPARE!
- **SIZE:** Unbelievable! Only 6¾" by 2⅜" by 9¾". COMPARE!
- **MICROCOMPUTER CONTROL:** All frequency control is carried out by a microcomputer.
- **MUSICAL TONE ACCOMPANIES KEYBOARD ENTRIES:** When a key is pressed, a brief musical tone indicates positive entry into the microcomputer. COMPARE!
- **PUSHBUTTON FREQUENCY CONTROL FROM MICROPHONE OR PANEL:** Frequency is selected by buttons on the front panel or microphone.
- **8 CHANNEL MEMORY:** Each memory channel is reprogrammable and stores the frequency and offset. Memory is backed up by a NICAD battery when power is removed.
- **INSTANT MEMORY 1 RECALL:** By pressing a button on the microphone or front panel, memory channel 1 may be accessed immediately.
- **MEMORY SCAN:** Memory channels may be continuously scanned for quick location of a busy or vacant frequency.
- **PROGRAMMABLE BAND SCAN:** Any section of the band may be scanned in steps of 5 or 10 kHz. Scan limits are easily reprogrammed.
- **DISCRIMINATOR SCAN CONTROL (AZDEN EXCLUSIVE PATENT):** The scanner stops by sensing the channel center, so the unit always lands on the correct frequency. COMPARE this with other units that claim to scan in 5-kHz steps!
- **THREE SCAN MODES WITH AUTO RESUME:** "Sampling" mode pauses at busy channels, then resumes. "Busy mode stops at a busy channel, then resumes shortly after frequency clears. "Vacant" mode stops at a vacant channel and resumes when signal appears. If desired, auto resume may be prevented by pressing one button. COMPARE!
- **REMOTABLE HEAD:** The control head may be located as much as 15 feet away from the main unit using the optional connecting cable. COMPARE!
- **PL TONE OSCILLATOR BUILT IN:** Frequency is adjustable to access PL repeaters.
- **MICROPHONE VOLUME/FREQ. CONTROL:** Both functions may be adjusted from either the microphone or front panel.
- **NON-STANDARD OFFSETS:** Three accessory offsets can be obtained for CAP/MARS or unusual repeater splits. CAP and Air Force MARS splits are BUILT IN! COMPARE!
- **25 WATTS OUTPUT:** Also 5 watts low power to conserve batteries in portable use.
- **GREEN FREQUENCY DISPLAY:** Frequency numerals are green LEDs for superior visibility.
- **RECEIVER OFFSET:** A channel lock switch allows monitoring of the repeater input frequency. COMPARE!
- **SUPERIOR RECEIVER:** Sensitivity is better than 0.28 uV for 20-dB quieting and 0.19 uV for 12-dB SINAD. The squelch sensitivity is superb, requiring less than 0.1 uV to open. The receiver audio circuits are designed for maximum intelligibility and fidelity. COMPARE!
- **ILLUMINATED KEYBOARD:** Keyboard backlighting allows it to be seen at night.
- **TRUE FM, NOT PHASE MODULATION:** Transmitted audio quality is optimized by the same high standard of design and construction as is found in the receiver. The microphone amplifier and compression circuits offer intelligibility second to none.
- **OTHER FEATURES:** Dynamic microphone, built-in speaker, mobile mounting bracket, external remote speaker jack (head and radio) and much, much more. All cords, plugs, fuses, microphone hanger etc. included. Weight: 6 lbs.
- **ACCESSORIES:** CS-ECK 15-foot remote cable. CS-6R 6-amp ac power supply. CS-AS remote speaker. CS-TTK touchtone® microphone kit (wired and tested).

AMATEUR-WHOLESALE ELECTRONICS ORDER NOW TOLL FREE

8817 S.W. 129th Terrace, Miami, Florida 33176
Telephone (305) 233-3631 • Telex: 80-3356
HOURS: 9 - 5 Monday thru Friday
• U.S. DISTRIBUTOR • DEALER INQUIRIES INVITED

VISA

800-327-3102

CREDIT CARD HOLDERS MAY USE OUR TOLL FREE ORDERING NUMBER.

Arnal Cook N9AKX
1591 S. Lane Ave., Apt. 23C
Jacksonville FL 32210

Police Freqs for the TR-2400

—a sleepless night for the mod squad

I do not need to extol the bounty of convenience and luxury Kenwood's new TR-2400 hand-held 2-meter transceiver has brought to VHF enthusiasts. Most hams, no doubt, have seen or read of its features—notably 10 channels of programmable memory and its ability to scan these memories, stopping on active or inactive channels. Being strictly a VHF enthusiast, my mind began to drift when my TR-2400 arrived to what the next advance in radio/scanner technology would bring forth. It didn't take very long to imagine the first tri-band programmable hand-held scanner. After all, the TR-2400 had broken the ground, at least in a single-band version.

I also began to ponder the possibilities of converting the TR-2400 to the "action band." One sleepless night was spent tracing the schematic lines and deciphering its method of operation. I would like to thank Trio-Kenwood Corporation for their practice of supplying block diagrams and full schematics with their products. I wish all manufacturers would make it a policy to do the same with every unit. This ham, for one, distrusts "black boxes."

Several possibilities emerged to modify the TR-2400 so that reception in the 154- to 158-MHz range would be possible. Three of them will be outlined here, from simple to complex. The simplest of these is currently working in my rig. The second requires moderate circuit modification, but may not work depending on the range of the vco. The third method requires additional parts and good instruments to adjust, but is sound in theory. I present these here in hope that someone else will follow my theories, try to implement them, and report their results. I cannot because I begin Navy pilot training at Pensacola, Florida, within two weeks of writing this draft and don't have the time!

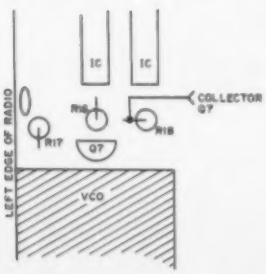


Fig. 1. Vco location.

Theory in Operation

The operation of the TR-2400 is fairly straightforward as frequency synthesizers go. Referring to your owner's manual (pages 14 and 15) with the following description may be helpful, but not necessary, to follow the principle of the synthesizer.

Transistors Q7 and Q8 and associated power supply pass transistors Q2 and Q3, respectively, form a complementary electronic switch—i.e., when Q2 is ON during receive, Q3 is OFF, and vice versa during transmit. Q2 controls the fixed frequency receive beat oscillator/tripler (X1, Q1). Q3 controls the transmit beat oscillator/tripler (X2, Q4). During transmit, positive bias on the base of Q7 causes it to conduct to ground and turn off Q2 and Q8, which turns on Q3 and Q4.

The output of Q4 (138.5 MHz) and the VHF voltage controlled oscillator (vco, Q10) are mixed, filtered, and amplified by Q5 and Q6. This forms a downconverter, much like the i-f system when in a receiver. As shown on the block diagram in the manual, the output of Q6 is always between 5.5 and 9.5 MHz for 2-meter operation (144.0—138.5=5.5 MHz). The full range is 5.4 MHz to 9.995 MHz. In receive mode, pass transistor Q2 activates Q1 (127.8 MHz) and D3. The output of Q1 is lower than Q4 by 10.7 MHz, which is the i-f frequency. In order to keep the output of Q6 between 5.5 and 9.5 MHz, the vco must drop its frequency by 10.7 MHz, too. Most of this drop is accomplished by D3 bypassing C27 when forward bi-

ased, effectively *increasing* the value of C26 (the value of two capacitors in series is lower than the smallest value; bypassing one of them therefore increases the value of capacitance in the circuit). This lowers the vco frequency by about 10.7 MHz.

IC Q20 is a binary-encoded 3½-stage decade programmable counter (i.e., it divides by any integer, not just powers of two). Actually, as used here, only 3 decades are programmable: units (A1-D1), tens (A2-D2), and hundreds (A3-D3). The thousands half stage (A4-B4) is wired at one thousand (i.e., A4 goes to Vdd and B4 goes to ground, a binary one). Frequency division of the signal from Q6 is therefore 1000 plus whatever is loaded into Q20 by the microprocessor, Q25 (and interface ICs Q23 and Q24). Divisors range from 1080 at 143.900 MHz to 1999 at 148.495 MHz, the limits of the TR-2400.

The phase comparator reference frequency (5 kHz) is derived from X3 (10.240 MHz) and fixed binary divider IC Q22. To get 5 kHz in this case, a divisor of 2048 is used, which is 2^{11}, hence pin Q11 on the schematic. 10,240 kHz ÷ 2048 = 5 kHz.

The divided outputs from both IC Q22 (reference) and IC Q20 (signal) are fed to IC Q21, the phase comparator. Any difference between phases in the two signals (usually caused by a difference in frequency) causes an error voltage to appear at pin 1, "AMP OUT." This output is proportional in magnitude to the phase difference of the two signals. This error voltage is applied to D2 (actually a varactor diode) to tune the vco frequency and hence correct the phase difference the comparator in IC Q21 senses. Simultaneously, this voltage is fed to four varactors in the front end (D1-4) to ensure peak tuning across the band in the receiver front end. The error voltage was measured at nearly 1/2 volt per megahertz of frequency change.

Back to the beginning for a moment. The transmit/receive switching voltage used to drive Q7 and Q8 is closely associated with the biasing voltage for diodes D9 and D8/D27. These diodes select the routing of the vco output signal to either the receiver (D9) or the transmitter (D8/D27) as it is needed.

To complete the theory of operation, the deviation for transmitting is developed in the vco. Output from microphone amplifier IC Q13 is applied to D5 in the vco, another varactor. Thus, modulation is true FM, produced directly at the VHF frequency without the use of frequency multipliers.

Conversion

The most commonly used portion of the VHF-hi public service band of usual interest lies almost exactly 10 MHz above the 2-meter amateur band (154 to 158 MHz). The transmitter frequency from the vco (143.9 to 148.495 MHz) is an appropriate injection frequency to the receiver for nearly the same range (+10.7 MHz = 154.6 MHz to 159.195 MHz).

The only trick necessary to accomplish this higher injection frequency is to use the higher-frequency transmitter beat oscillator (Q4) with the receiver and turn off the receiver beat oscillator (Q1) and D3. Two wires can be rerouted through the S. TONE switch (if not being used) to shift the receiver up band. No critical or sensitive circuits are disturbed, so performance is virtually ensured.

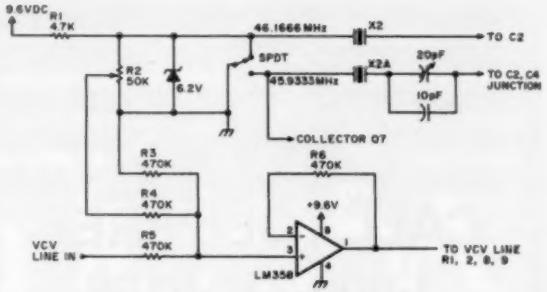


Fig. 2. Suggested circuit. Note: LM358 is a dual op amp in an 8-pin DIP designed for single-ended power supplies.

In operation, the collector of Q7 is bypassed to ground, which switches the oscillators, as needed, but not the radio circuits.

The Mod

Turn the radio off and the TX offset to BU OFF. Remove the four rear screws, back cover, battery cover, battery pack, and the two screws beneath the battery holder. Disconnect the battery. Locate the empty area in the center of the rear circuit board where the tone board would go. Find the red (V+) and black (ground) wires and short them together (use a piece of insulated wire if you like). The red line will be disconnected from V+ in a moment. Replace the back cover without screws.

Turn the radio over, face up. Carefully lift the face plate up and off to the right. All these ICs are CMOS and could possibly be destroyed by static charges on loose fingers or tools. There is no need to touch these, *so don't!* Note: You will be on a remote lead of the microprocessor (PA2), but this lead has static protection (C9, R66).

Find the S. TONE switch assembly in the top, center. Just to the right of this switch is a black wire marked B1. Follow this wire down to the bottom edge of the board. Remove this one end of the wire from this point by cutting or unsoldering it. This disconnects the red wire on the bottom board from V+. Lay the black wire aside.

In the lower left corner is a shielded portion of the circuit. This is the vco. At the top of this box is transistor Q7 and its associated resistors. To the right, in the 2 o'clock position, is R18. See Fig. 1. The wire lead of R18 is the connection point for the end of the black wire removed above. The lead on R18 has a ceramic coating for insulation, part of which must be removed to make a place to solder the black wire. This coating will chip away easily under a pen knife, razor blade, or even serrated plier tips if done very gently. After removing the insulation, solder the black wire to the resistor lead quickly. These small resistors won't handle much heat for long. Don't break the circuit. This is just a convenient attachment point.

That is the entire modification. Put the case together, careful not to pinch any wires, and connect the battery pack. Be careful not to overtighten the screws. Turn the radio on before moving the TX OFFSET switch from BU OFF.

Operation

This modification causes the ON AIR indicator to be on when the S. TONE switch is depressed. The transmitter is *not* on. The microprocessor (pin PA2) reads the collector of Q7, which you just shorted to ground, as the transmitter.

CALL TOLL FREE
1-800-238-6168

In TN. call 901-683-9125
MEMPHIS AMATEUR ELECTRONICS
(Formerly-Germantown-Sere-Rose)

Authorized Dealer for: Kenwood, Yaesu, Icom, Drake, Mirage, AEA, Info-Tech, Ten-Tec, MFJ, Cubic, and B&W.

MON-FRI 9:00—5:00
SAT 9:00—12:00

139

Write: 1465 Wells Stat. Rd., Memphis, Tn. 38108

Only the transmit beat oscillator is on. While in this mode, I suggest you keep the F LOCK *ON* and the TX switch in the STOP position to avoid inadvertent transmission while monitoring. If you do transmit, the transmission will be in the amateur band as usual.The transmitter is *not* shifted up band by this modification.

To receive the desired new channel, subtract 10.7 MHz from the known frequency (e.g., 155.61 MHz − 10.7 = 144.91). Make sure the S. TONE is off (up position) and program the radio as usual for the corrected frequency (e.g., 4.910). Now depress the S. TONE switch. As the ON AIR flag appears, your radio is tuned to the new channel.

While in this mode, the keyboard will not function, just as if you were transmitting; thus, there is no band scan or memory scanning. These features may be regained by the more complex modifications, or by isolating pin PA2 of the microprocessor and keeping it near Vcc (which I do not recommend). If the radio is turned on with the S. TONE switch already depressed, an incorrect display is likely to occur. Simply turn the S. TONE switch *off*, then *on* again to correct the readout. Receiver sensitivity in the new band will fall off because varactors D1-D4 (front end) are not being properly tuned for this higher range. However, sensitivity remained sufficient to receive my local sheriff's department near the edge of the county.

Other Theories

The best theory requires some careful circuit work, but has great promise. Basically, if you add 2000 to the divisor at IC Q20, all frequencies would be shifted up by exactly 10.0 MHz. This is easily done by lifting B4 from ground and connecting it to Vdd, or A4. Thus, programming would be just as on 2 meters—just the last 4 digits of the frequency, without the need for a correction factor. Using this higher divisor would allow using the receive beat oscillator and keep band and memory scan capability.

The easiest way to keep the vco working 10 MHz higher than usual above the receive beat oscillator is to isolate D3 in the vco by breaking the control line from Q2. An additional switch would be needed to switch it back in for normal two-meter operation.

A more extensive circuit addition may yield better results. The AMP OUT line from IC Q21 goes from about 1.2 volts to 3.4 volts (a range of 2.2 volts) from 143.9 MHz to 148.5 MHz (a spread of 4.6 MHz), or roughly +.5 volts/MHz. Thus, to go 10 MHz higher would require about 5 volts more, in addition to 3.4 volts, for a maximum swing of 8.4 volts. This is below the battery voltage and is therefore feasible, but may not be practical. There are several limiting factors that must be checked before implementing either modification: 1. capacitance range and response curve of D2 for these voltages; 2. maintaining the supply voltage; and 3. will IC Q20 handle an input frequency of 20 MHz?

The output of the AMP OUT line of IC Q21 is limited to Vdd, the supply voltage from regulator Q9. This is 6 volts, or about 10 MHz of total possible spread, using 1 volt as a minimum figure and linear mode of operation from D2. One possible solution to this limited voltage swing is an amplifier stage with a voltage gain of 2 connected to the battery line. The output would feed varactors D2 and D1-D4 in the front end. This may tune not only the vco over the full 15 MHz, but also the front end to maintain sensitivity. However, it may be impractical to use the unregulated battery voltage. Low batteries and varying load conditions (e.g., audio) may cause voltage fluctuations and instability in the vco.

Still one more option exists. Alternating X2 with a crystal for 45.9333 MHz would shift the transmit beat oscillator exactly 10.0 MHz above the receiver oscillator instead of 10.7 MHz. These crystals would be switched in or out by means of their ground connection. These two crystals (X2 and X2A) would differ by less than 250 kHz, so the bandwidth of the oscillator should not be a problem. The accurate tuning of these crystals is imperative. To tune the front end, an op amp could be used in a voltage summing circuit. (See the suggested circuit in Fig. 2.)

The trimpot would be adjusted to add a preset value to the vcv (varactor control voltage) line to feed the front end (only) when switched in. When not in use, both sides of the pot would be grounded so it would add zero volts for normal operation. Note: X2A may also work on the receive oscillator side if Q1 is broadband enough, and D2 will work on a higher voltage. If so, change R3, 4, and 5 (Fig. 2) to 220k and connect the vcv line to D2 as well. Eliminate the connection to Q7. This will restore memory scan again.

It is my hope that someone else will pick up on these ideas and work them out to completion. In emergencies, such capability to switch between ham and police or fire department channels could prove very valuable.

Good monitoring! ■

ICOM Presents the Minicom IC-25A

Imagine..25watts/5 memories/2 scanner systems in a 2"H x 5½"W x 7"D 2 meter transceiver!

A *very* small package with a 25 watt punch, the IC-25A is a full featured FM transceiver for the space conscientious operator. Nearly the same size as an automotive AM radio, the IC-25A will fit in places usually considered impossible for a one piece 2 meter transceiver. The IC-25A is no lightweight when it comes to features:

- 5 memories. Store your favorite frequencies.
- Priority channel. Monitor your most important frequency.
- 25 watts high/1 watt battery saving low power.
- Touchtone™ mic standard..no extra cost...to work your favorite autopatch repeater.
- Full band scan/programmable scan (set your own limits)/memory scan....all with automatic resume after preset delay or carrier drop.
- 2 VFO's with data transfer standard.
- 2 tuning rates 5KHz (A VFO) or 15 KHz (B VFO).
- Nor/Rev switch for instant monitoring of repeater inputs.
- Memory back up power supply option holds memory when attached.

Actual Size.
(Clip this actual photo out and try it in your car.)

2112-116th Avenue NE, Bellevue, WA 98004
3331 Towerwood Drive, Suite 307, Dallas, TX 75234

ICOM

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations, limiting spurious emissions.

Jim Gray W1XU
73 Magazine Staff

Those Amazing Bobtails

— the current-fed connection

The Bobtail antenna system described in the references has created quite a stir. Various combinations of construction methods and feed systems have been suggested through a great deal of correspondence between various amateurs.

A nagging problem has been the lack of a satisfactory explanation of the operation of the antenna when it is current fed. It is hoped that this article may shed some light on this subject and spur others on to try this excellent antenna.

To begin, we need a couple of definitions: 1) Voltage feed—feeding an antenna at a point where a voltage loop (or maximum) occurs. 2) Current feed—feeding an antenna at a point where a current loop occurs.

Antenna theory shows that whenever you have two vertical radiating elements spaced 1/2 wavelength apart, the radiation will be reinforced in a direction perpendicular to a line drawn between the antennas. By using three vertical radiating elements (or four, five, or more) all spaced 1/2 wavelength apart, the radiation will be reinforced in the same directions as before, approximately proportionally to the number of radiating elements. Such an antenna is known as a curtain. Because our antenna has only three elements, it is known as a short, or Bobtail, curtain.

Curtain antennas of the type described are bidirectional, with radiation patterns that look like elongated figure-eights viewed from the top of the antenna looking down. The figure-eight pattern extends perpendicularly from a line drawn between the antennas, and when many elements are phased, the figure becomes longer and skinnier and the result is a bidirectional beam: a *broadside array*.

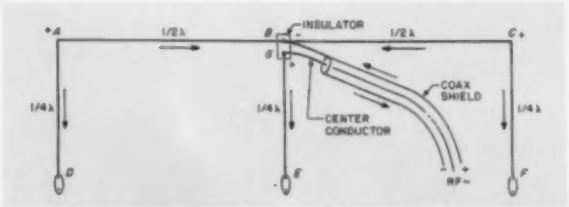


Fig. 1. The current-fed Bobtail.

In order to understand the operation of the Bobtail curtain antenna, one must consider the antenna currents in terms of their magnitude and phase relationship. Ideally, in an antenna of this type, all radiation is from the vertical elements, and little or no radiation occurs from the horizontal sections (flat-top portion) because these exist merely to achieve the proper phase relationship between the vertical elements.

Heretofore, the Bobtail has been *voltage* fed by means of a coupling network attached to the bottom of the center element, although it is possible, if desired, to attach the coupling network to the bottoms of either of the vertical end elements.

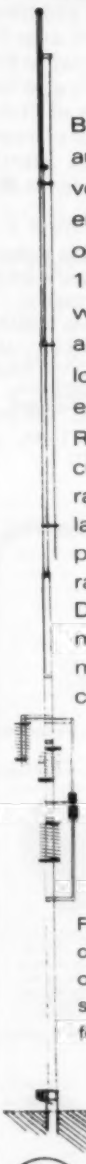
For many reasons, including convenience, ease of matching, simplicity, elimination of coupling networks, and other factors, it has been considered desirable to find another way of feeding the Bobtail, and such a method has been reported as having been used with success by a number of different amateurs. Here's how it works:

In Fig. 1 observe that the Bobtail array, as before, consists of the three quarter-wave vertical elements at A, B, and C. The two end elements at A and C are essentially a portion of the flat-top and connected directly thereto.

The center vertical element is separated from the horizontal flat-top portion by a small insulator at G, and the conductors of a coaxial feedline are attached to the flat-top and to the vertical element, across the insulator, with the center conductor connected to the vertical, and the braid connected to the exact center of the flat-top, at B.

Vertical element A is separated by 1/2 wavelength from element B, and vertical element B is separated by 1/2 wavelength from vertical element C. Flat-top sections A-B and B-C act as phasing lines to make the current relationships in the antenna come out properly, i.e., the current in section A-B is 180° out of phase with the current in B-C, and therefore they cancel.

STILL MORE USABLE ANTENNA FOR YOUR MONEY . . . PLUS 30 Meters!



Butternut's new HF6V automatic bandswitching vertical lets you use the entire 26-foot radiator on 80/75, 40, **30**, 20 and 10 meters (full quarter-wave unloaded performance on 15 meters). No lossy traps. Butternut's exclusive Differential Reactance Tuning™ circuitry uses rugged ceramic capacitors and large-diameter self-supporting inductors for radiation efficiency and DX performance unmatched by conventional multiband designs of comparable height.

For complete information concerning the HF6V & other Butternut products see your dealer or write for our free catalog.

BUTTERNUT ELECTRONICS CO.
GARY AIRPORT
BOX 356E Rte. 2
SAN MARCOS, TX 78666

DAIWA Communications Essentials

Simultaneous SWR/Forward & Reflected Power Readings

SWR & POWER METERS

Tolerance: ±5% of full scale
Input/output Impedance: 50 Ohms
Connectors: SO-239

Model CN-620B (New 2 Kw Scale)

Frequency Range: 1.8—150 MHz
SWR Detection Sensitivity: 5 Watts min.
Power: 3 Ranges (Forward, 20/200/2000 Watts) (Reflected, 4/40/400 Watts)
Dimensions: 165 x 75 x 97 mm; 6.5 x 3 x 4 in.

Model CN-720B (New 2 Kw Scale)

Frequency Range: 1.8—150 MHz
SWR Detection Sensitivity: 5 Watts min.
Power: 3 Ranges (Forward, 20/200/2000 Watts) (Reflected, 4/40/400 Watts)
Dimensions: 180 x 120 x 130 mm; 7 x 4.75 x 5 in.

Model CN-630

Frequency Range: 140—450 MHz
SWR Detection Sensitivity: 5 Watts min.
Power: 2 Ranges (Forward, 20/200 Watts) (Reflected, 4/40 Watts)
Dimensions: 180 x 85 x 120 mm; 7.12 x 3.37 x 4.75 in.

Automatic Antenna Tuner Model CNA-1001

Frequency Range: 3.5—30 MHz (including WARC Bands)
Power Rating: 500 Watts PEP
Internal Dummy Load: 50 Watts/1 Minute
Impedance Matching: 15-250 Ohms to 50 Ohms Resistive
Input Power Required for Automatic Tuner: 1, 5 or 10 Watts (Set by rear panel switch)
Tune-up Time: 45 Seconds Max.
Power Requirement: 13.8 VDC/.2 Amp

Coaxial Switches

Power Rating: 2.5 kW PEP, 1kW CW
Impedance: 50 Ohms
Insertion Loss: Less than .2 dB
VSWR: 1:1.2
Maximum Frequency: 500 MHz
Isolation: Better than 50 dB at 300 MHz; better than 45 dB at 450 MHz; adjacent terminal
Unused terminals grounded
Connectors: SO-239

4 Position/ Model CS-401

2 Position/ Model CS-301

Exclusive USA agent for these units; inquiries invited.

Write for literature.

J.W. Miller Division
BELL INDUSTRIES
19070 REYES AVE. P.O. BOX 5825
COMPTON, CALIFORNIA 90224
Phone (213) 537-6000

The currents in the vertical elements are in phase and add because the current is traveling in the same direction at any given instant (but the currents are not equal in magnitude). The reason for this is that the vertical elements are each only 1/4 wavelength at the operating frequency. The current divides between the vertical elements in a ratio of two to one.

In order to satisfy the phase requirements, the magnitude of the current in the end elements must equal the magnitude of the current in the center element. Since there are two end elements and only a single center element, the current in the center element must be twice that in each of the end elements.

If you study Fig. 1, you will notice that for a particular given half-cycle, the + and − signs are as shown, changing sign at each 1/2-wave point. We have assumed the feedline to be exactly 1/2-wavelength long. The arrows between the plus and minus signs show the direction of current during the particular half-cycle we've chosen to illustrate. During the next half cycle, note that the polarity at each of the half-wave points will change and the current arrows will reverse direction, but also note that, once again, the currents in flat-top sections A-B and B-C will cancel. The currents in the vertical elements will again add in-phase in spite of the fact that their direction is reversed. Thus, on each half of every full cycle the vertical elements always add in-phase and the flat-top sections always cancel.

Interesting Side Notes

If you turn a current-fed Bobtail upside down, it looks like a much more familiar antenna system. By eliminating the phasing line (flat-top) and substituting ground, you have three 1/4-wave verticals spaced a 1/2-wave apart. This is very common practice in antenna systems, for example, in the broadcast industry for directional beaming.

The disadvantage of all but perfect ground systems is the resistance loss in imperfect conductors. Consider, now, what happens when we use the Bobtail array: The "ground" becomes the horizontal wire or flat-top—nearly loss-free compared to ordinary ground and, better still, elevated above earth by at least a 1/4 wave.

What this means is that the antenna becomes more efficient and the radiating portion is raised. The high-current portion of an antenna is the portion which does the biggest share of the radiating and that is why it is best to get it as high and as in the clear as possible. The Bobtail array accomplishes these things and, therefore, is a good antenna compared to one in which the radiating portion is low and the losses in ground resistance are high.

One more item. Radiation from a Bobtail is *vertically* polarized and therefore, when placed as in the configuration shown in Fig. 1, exhibits not only gain, but a very low angle of "take-off," as is typical of many vertical radiators. Hence, it's a good DX antenna. ■

References

1. Jerrold A. Swank W8HXR, "The 20-Meter Double Bobtail," *73 Magazine*, May, 1980.
2. Jerrold A. Swank W8HXR, "The Amazing Bobtail...Our Readers Respond," *73 Magazine*, December, 1980.
3. Alan Kaul W6RCL, "The Bobtail Curtain: Round Three," *73 Magazine*, July, 1981.

PLUG INTO SAVINGS!

We've cornered the market!

VERSATILE USER PROGRAMMABLE CHIP — MM5709N N.S.C.
- Any key sequence, including constants and data entry points, may be stored automatically in the Load Mode and executed in the Run Mode.
- 102 step storage capacity of up to 47 different keys arranged in a 12 x 4 matrix.

It's possible to build many projects with this chip. Pin outs and specs supplied with order (#C10003). $4.95

WATCH GUTS
S10009 LED WATCH GUTS (untested) .75
S10010 L.C.D. WATCH GUTS (untested) .75
SPECIAL Mix and Match. BUY four watch guts for $2.00
S10014 Motorola 4MHz Crystal Oscil. 5V in, 4MHz Out. TTL Compatible. w/pin outs 4.95

S10001 PARTS BOARDS — The perfect way to fill up your parts bin on a budget! We found all sorts of neat resistors, Electrolytic, Caps, Ics, etc. 2.00

M&M 98
Electronic Sales, Inc.
Phone (206) 682-5025 (in Wash. State)
2300 First Ave., Seattle, Washington 98121

JANUARY SPECIALS

X10003 4.5 VC @ 200MA ADAPTOR $2.95 ea.

INSTANT REBATE
When your order totals $50 or more, you may take $5 off the total of your order.
It's almost like finding a five dollar bill!

SHOCKING SAVINGS CONT.
F10042 1000MFX25V Electrolytic (R)
35¢ ea BULK PRICE 10-3.00
S10002 22-44 156 Tin. Edge Connector 99¢

X10010 Color Burst Crystal 3.579545 MHz .50 OR 10/4.75

Z10006 10 Segment L.E.D. Bar Graph (Green) 3.50

Z10009 4 Digit, .3" Clock Display w/colon, CC, Red 1.95

COPPER CLAD
S10024 8" x 9" Double sided P.C. Material (G-10) Epoxy 1.25

A10023 Solderless Lug Assortment 50 Popular Sizes Just $2.49

LINE PRINTER HAMMER DRIVER BOARD
Each board contains approx. 130 each 2N5296 (Sprague) Darlington NPN hfe 750, 1.5A. About $130.00 worth over 100 1N4001 diodes, plus support chips. The whole package is yours for only $19.95. S10023

SHOCKING SAVINGS
B10004 1.5V 'N' Cell (Eveready) This will run your watch guts a lot longer than a button cell! S .25
R10009 Right Angle Photo Jack (P.C. Mount) 20¢ each
N10009 Acid Brush 25¢ each 5/$1.00
W10001 Solder Brush 50¢ each 3/$1.00
W10009 18-3 8' Line Cord $2.95 2/$5.00

¼ WATT RESISTOR ASSORTMENTS

MAN #	DESCRIPTION	PRICE
A10003	Resistor Assortment A 10 each: 1 ohm, 1.5 ohm, 2 ohm, 2.7 ohm, 3 ohm, 3.6 ohm, 4.7 ohm, 5.6 ohm, 6.8 ohm, 8.2 ohm.	$2.95
A10004	Resistor Assortment B 10 each: 10 ohm, 12 ohm, 15 ohm, 18 ohm, 22 ohm, 27 ohm, 33 ohm, 39 ohm, 47 ohm, 56 ohm.	2.95
A10005	Resistor Assortment C 10 each: 68 ohm, 82 ohm, 100 ohm, 120 ohm, 150 ohm, 180 ohm, 220 ohm, 270 ohm, 330 ohm, 390 ohm.	2.95
A10006	Resistor Assortment D 10 each: 470 ohm, 560 ohm, 680 ohm, 820 ohm, 1K, 1.2K, 1.5K, 1.8K, 2.2K, 2.7K.	2.95
A10007	Resistor Assortment E 10 each 3.3K, 3.9K, 4.7K, 5.6K, 6.8K, 8.2K, 10K, 12K, 15K, 18K.	2.95
A10008	Resistor Assortment F 10 each: 22K, 27K, 33K, 39K, 47K, 56K, 68K, 82K, 100K, 120K.	2.95
A10009	Resistor Assortment G 10 each: 150K, 180K, 220K, 270K, 330K, 390K, 470K, 560K, 680K, 820K.	2.95
A10010	Resistor Assortment H 10 each: 1M, 1.2M, 1.5M, 1.8M, 2.2M, 2.7M, 3.3M, 3.9M, 4.7M, 5.6M.	2.95
A10011	Resistor Assortment A-H Includes all resistor assortments (800 pieces)	17.95

5-PACK CALCULATORS
$6.95
Unbelievable Assortment!!
Factory lemons — most are easily repaired. National Semiconductor
(A10014)

GUARANTEED DEFECTIVE! A complete 12 hour digital clock. Some are manufacture line rejects, some are returns, and some are just scratched. Features hours, minutes, alarm, snooze alarm. Parts value alone would equal $20.00 - you pay only $6.95 ea. (S10013)

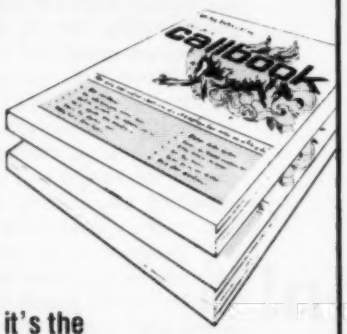
For Phone Orders:
TOLL FREE HOT LINE
1-800-426-0634
For Areas Outside Of Washington State (Including Alaska & Hawaii)

TERMS: Minimum order $10.00/U.S. Funds Only / Open account to schools and government agencies / All orders shipped U.P.S. or P.P. / Add 10% (postage & handling) for orders under $100.00. For orders greater than $100.00, we'll pay the freight / Back-ordered items shipped prepaid / Washington State residents add 5.4% sales tax / MasterCard & Visa accepted / C.O.D.'s add $2.00 extra.

We reserve the right to limit quantities / All items subject to prior sale / We reserve the right to substitute manufacturers.

When it comes to

AMATEUR RADIO QSL's . . .



it's the

ONLY BOOK!

US or Foreign Listings

1982 callbooks

NOW READY!

Here they are! The latest editions. World-famous Radio Amateur Callbooks, the most respected and complete listing of radio amateurs. Lists calls, license classes, address information. Loaded with special features such as call changes, prefixes of the world, standard time charts, world-wide QSL bureaus, and more. The U.S. Edition features over 400,000 listings, with over 70,000 changes from last year. The Foreign Edition has over 370,000 listings, over 60,000 changes. Place your order for the new 1982 Radio Amateur Callbooks, available now.

	Each	Shipping	Total
US Callbook	$18.95	$3.05	$22.00
Foreign Callbook	$17.95	$3.05	$21.00

Order both books at the same time for $39.95 including shipping.

Order from your dealer or directly from the publisher. All direct orders add shipping charge. Foreign residents add $4.55 for shipping. Illinois residents add 5% sales tax.

SPECIAL LIMITED OFFER!
Amateur Radio Emblem Patch
only $2.50 postpaid

Pegasus on blue field, red lettering. 3" wide x 3" high. Great on Jackets and caps.

ORDER TODAY!

RADIO AMATEUR callbook INC.
Dept. B
925 Sherwood Drive
Lake Bluff, IL 60044, USA

↙61

DOUBLE BAZOOKA COAXIAL ANTENNA

- Injection Molded Plastic Fittings for Strength, Durability and Weather-proofing.
- Broad Banded Low VSWR
- No Tuner or Balun Required
- Feed With Any Length 50 Ohm Coax
- Power Handling Capacity - Two Kw
- Not A Kit - Ready For Use - Made In USA
- Steel Eyeletts For Installation and SO-239 Fitting Are Molded Into Antenna

80 or 40 Meter . . . . . 39.95 ea.
20, 15, or 10 Meter . . . . . 34.95 ea.

power gain systems
1007 Cypress
West Monroe, La. 71291
↙96

☐ Payment enclosed $_____
☐ VISA ☐ MC
Card no._____ Exp. date_____
Signature_____
Name_____
Address_____
City_____ State___ Zip_____

New Automatic Antenna Tuner Auto-Track AT 2500

Designed and Built by J. W. Miller Div.

Check these state-of-the-art specifications

- Power Capability: 2500 W PEP.
- Frequency Range: Continuous 3.0 to 30 MHz (including WARC Bands).
- Impedance Matching: 10 ohms to 300 ohms to 50 ohms resistive.
- Direct Reading SWR Meter: 1:1 to infinity.
- Direct Reading Power Meter: Two meter scales from 0 W to 250 W and 0 W to 2000 W. Front panel switch selects FWD or Reflected Power *(illuminated panel meters)*.
- Power meter displays RMS with continuous carrier and automatically displays PEAK when driven with SSB signal.
- Average "Automatic" tune-up time: 5 seconds or less.*
- Tune-up time not affected by power level (can be as low as 1 W (5-10 W preferred).
- Power requirements are 115/230 VAC 50-60 Hz, 10 W operating/5 W standby; or 13.8 VDC, 1 A operating/.5A standby.
- Antenna tuner packaged in cabinet 17"W x 5¾"H x 14"D (Front panel handles & rack mount optional at extra cost.)

Write for literature.

*Specifications subject to change without notice.

Dealer Inquiries Invited
↙309

J. W. Miller Division
BELL INDUSTRIES
19070 REYES AVE. ■ P.O. BOX 5825
COMPTON, CALIFORNIA 90224
Phone (213) 537-5200

↙See List of Advertisers on page 114

David J. Brown W9CGI
Route 5, Box 39
Noblesville IN 46060

Shoot the Moon!

— visual tracking for your EME array

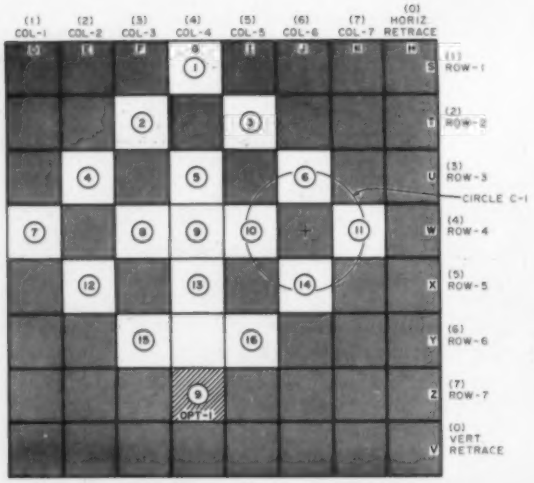


Fig. 1. Video monitor screen presentation. White squares with numbers are the maximum number of squares that can be lit. Dark areas are never lit. One possible moon image is shown by circle C-1. This would light squares 6, 10, 11, and 14. Adjust your lens or lenses for approximately this kind of spot size. The numbers correspond to the LDRs in Fig. 10.

Is your OSCAR or EME array all automated for tracking? Mine is, but I still wanted a means of visually tracking in a manual mode. This article details the simple "moon" camera I came up with to look at the moon while I stayed comfortably in my basement (Indiana winters get cold!). It also makes a fine motion detector or low-resolution surveillance camera.

Take a look at Fig. 1 for a moment. What I have is the screen of a TV set or, in my case, a video monitor. There is no reason why you can't feed the video output of my simple camera to one of the TV game modulators and pipe it into any TV set as rf on whatever channel the game modulator outputs on.

As shown, the spot or image of the moon has been concentrated into a round circle that just illuminates one or more of the photosensitive devices (more on them later). Whenever light shines on these devices, their resistance is greatly lowered and I sense that change to light a square on the monitor screen. In order to have the different positions on the screen represent different aiming positions of the antennas, there are two main requirements.

The first and easiest is that the camera be physically boresighted to the antenna. That's just a fancy way to say that it has to be aligned to look where the antenna is looking.

Secondly, the photo devices must be arranged in an array that duplicates

what you want to see on the screen and then scanned in step with the monitor scanning. These last two requirements are met easily using the circuitry and board layouts provided by this article.

Since I have started you out at the photo-sensing end, let's begin there on the circuitry and boards. The first thing you will notice is all the boards are round instead of square or rectangular. This allows for mounting in a round enclosure (details later, under Mechanical Assembly). The first board to consider is the LDR Board, shown in Figs. 2 and 4. I used light-dependent resistors (LDRs) as photo devices; mine are about ¼" in diameter at the light-input end. This allows the array of 16 LDRs you see the pattern for to fit easily on my round board.

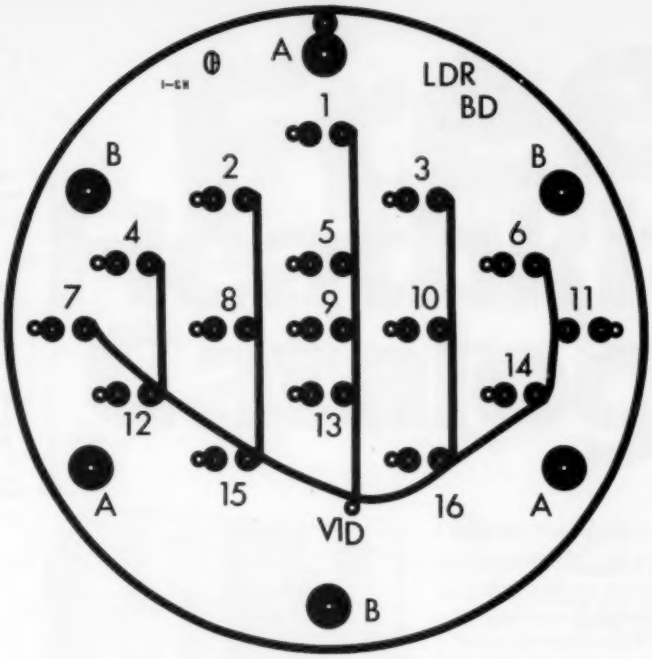


Fig. 2. Foil side of LDR board.

To mount the LDRs in the board, you need sockets of some kind. This avoids direct soldering and the possible altering of the resistive characteristics of the LDR. I highly recommend an item called a matrix pin by AMP, Inc.; it is their part number 380598-2. These are single-terminal push-in sockets and are sold by many parts houses and the magazine advertisers. Just drill out the circles to hold the sockets of your choice and load the board up as shown.

All leads come to the board from the copper side and pass through their holes, leaving a small amount of the stripped lead on the copper side to solder to. When this board is complete, there should be seventeen leads 4" to 5" long coming off the copper side. (Use different colors to avoid confusion.) 16 leads are to one side of each LDR, and one lead is common to all LDRs and is called the video lead (VID). There is really no easy way to test the board at this point, so set it aside and go to the counter chain schematic in Fig. 3. The corresponding foil and component sides are shown in Figs. 5 and 6.

The counter chain should go together quickly, and it can be checked out fully when completed—less any other boards. Load the board as shown and then check the test points using a frequency counter or oscilloscope at each test point against Table 1. The starting point is at the 555 IC, as this is the master clock. It should run at 122.88 kHz, and you adjust to that using the PC board thumbwheel pot, Ra. The set you use for a monitor will more than likely lock up (have steady sync) if the clock is from 122.0 to 123.5 kHz, but you may have something called flutter due to a difference between your divided-down vertical (59.57 to 60.3 Hz in the clock range just given) and the proper 60-Hz rate used to avoid beats against the power line 60 Hz.

The wide range of tolerance on most TV sets allows you a lot of leeway

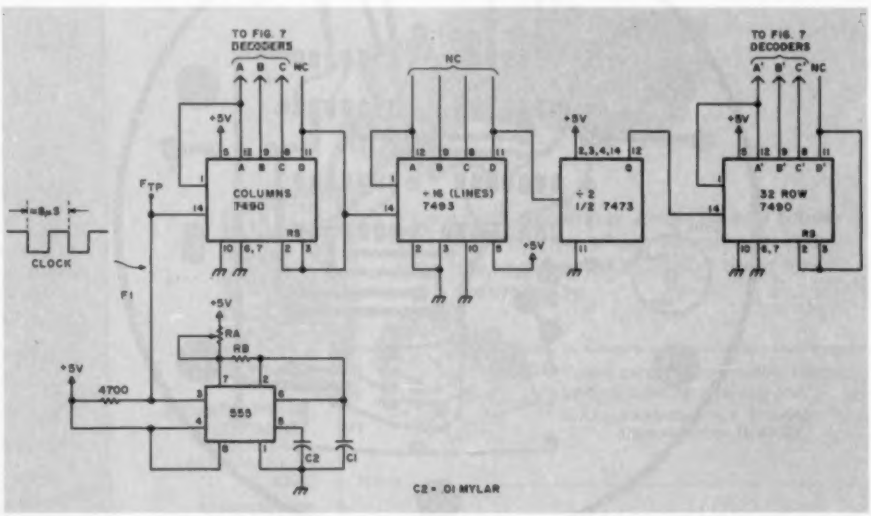


Fig. 3. Counter chain. Set for a frequency of 125 to 126 kHz at F_{TP} test point. For this application, C1 = 220 pF, Ra = 10k thumbwheel PC pot, Rb = 18k, ¼-W fixed resistor. General formula is: f = 1/T = (1.44)/Ra + 2Rb) × C.

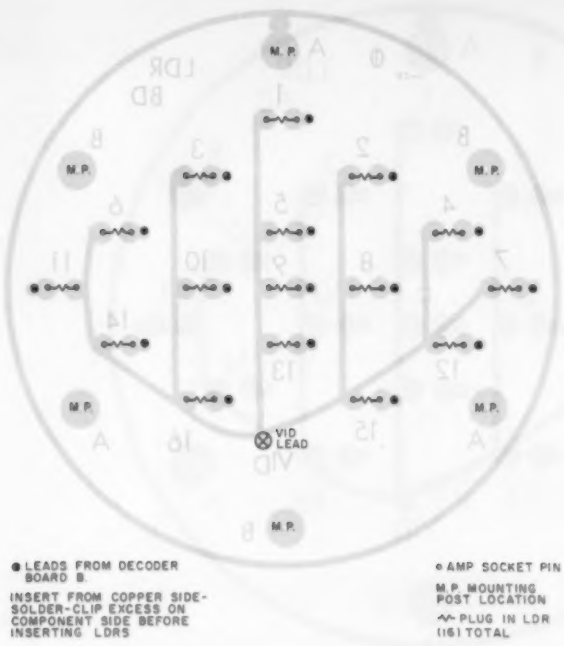

M.P.
VID LEAD
● LEADS FROM DECODER BOARD B.
INSERT FROM COPPER SIDE-SOLDER-CLIP EXCESS ON COMPONENT SIDE BEFORE INSERTING LDRS
○ AMP SOCKET PIN
M.P. MOUNTING POST LOCATION
PLUG IN LDR (16) TOTAL

Fig. 4. Component side of LDR board. M.P. designates mounting post (threaded spacer) locations. Use alternate locations between any board pair, thus only three spacers looking like a triangle between any board pair. Small circles are socket pins for LDRs. Solid dots are leads from decoder board B and should be inserted and soldered from the copper side and excess lead on component side clipped off flush with board. Resistor symbols are LDR locations.

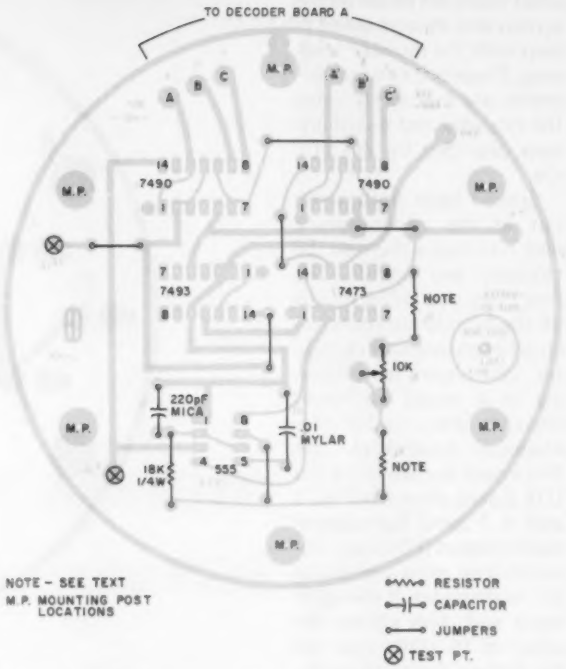


Fig. 6. Component side of counter chain board. Standard schematic symbols are used to show component mounting locations. Solid lines connecting dots indicate jumper leads. Circled x indicates test point.

in the setting of Ra where the set will lock up and look alright. If you can't get things as good as you want using a 10k pot for Ra and jumpers in the fixed Ra positions, a smaller pot can be used along with fixed resistor(s) to allow Ra to effectively tune slower. You would have to find the two extremes of Ra settings that create a locked-up picture, measure the resistance of Ra in each case, and use the difference as the new Ra value. Then fixed resistors make up the jumpers. Remember, the total must be 10k.

Example: If the set locked up alright on resistor Ra settings of 2500 Ohms to 7500 Ohms, use a new Ra of 5k and one fixed resistor of 2500 Ohms in either fixed Ra (jumper) position. Your new range then becomes 2500 to 7500 Ohms.

Ignoring the +V and ground leads needed by all boards except the LDR board, there are only six leads leaving the counter chain board (A, B, C, A', B', C'), and they all go to the points lettered the same on

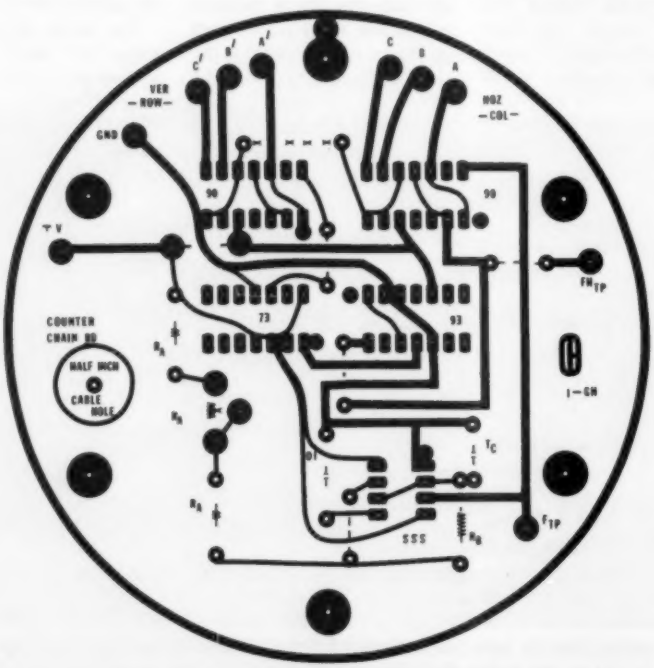


Fig. 5. Foil side of counter chain board.

WORLD TIME WATCH

the first microprocessor watch made especially for hams

24 hr. timer

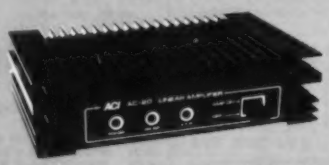
microprocessor water resistant

solar assist

New Low Price –$59.95

The HAM-1 functions include local time, world time, (G.M.T. too) count-up and count down chronometer, day, month, date, alarm and hourly chime. It's ideal for log-keeping, DX time conversion and 10 minute I.D. timing. The HAM-1 features a high contrast Seiko display and solar cell battery assist. Battery life is better than 4 years. The HAM-1 is water resistant to 20 meters, the case is 100% solid stainless steel and the crystal is scratch resistant mineral glass. The HAM-1 is rugged and durable and has a 1 year warranty.

2 METER AMPLIFIER $39.95



• 2 Watts In, 10 Watts Out • V.S.W.R. Protected • Can be Used for F.M. & S.S.B. • Led Status Indicators • Low Loss SO-239 Connectors • Current Drain Less Than 2.5A at 13.6 V.D.C. • Massive Heatsink • Built In T/R Switch

TEMPO S-1 UPGRADE KITS $39.95

Upgrade your early Tempo S-1 to current Production Specifications, kits include: • 450 M.A.H. Battery Pack • New Case Assembly • All New Escutcheons • Spkr./Mic. Jack w/Dust Cap • New Earphone & Jack • P.C.B. and Parts for Easy Installation • Detailed Instruction Manual • For Radios With & Without T.T. Pad.

Other Accessories Available:

Spkr/Mic. Designed for S-1's. . . $24.95
Heavy Duty Belt Clip. 7.50
Flex Antenna 6.00

To Order Call or Write to:

ADVANCED COMMUNICATIONS INTERNATIONAL
2411 Lincoln Avenue
Belmont, CA. 94002 U.S.A.
(415) 595-3949

Add $3.00 per order for shipping & handling. California residents add 6% sales tax. Visa, Master Charge accepted.

448

Free Heathkit Catalog

Discover the newest in amateur radio – all in easy-to-build, money-saving kits.

- Complete line of transceivers, including the popular Heathkit HW-101.
- New deluxe antenna tuner puts you in control of all your power.
- Unbeatable values in receiver/transmitter combos.
- VHF & HF Wattmeters
- Rugged Linear Amps
- Exciting 2-Meter Digital Scanning Transceiver

Plus a complete line of antennas and accessories...all money-saving values, now in the new, 104-page Heathkit Catalog. Send for yours today.

55

Please send my free Heathkit Catalog. I am not currently receiving one.

Send to **Heath Co., Dept. 011-862 Benton Harbor, MI 49022**

Name _____

Address _____

City _____ State _____

AM-421 Zip _____

If coupon is missing, write Heath Co., Dept. 011-862 Benton Harbor, MI 49022

In Canada, write Heath Co., 1480 Dundas Highway East, Mississauga, Ontario L4X 2 R7

decoder board A (Fig. 7). If these points are outputting according to Table 1, the 7442 decoders (IC1, IC2) will decode the BCD line codes into one of ten outputs. Since the D line is not used off the 7490s, the 7442 becomes a one-of-eight decoder. In IC1, positions 1 to 7 represent seven vertical columns across your monitor screen. Position 0 is left as horizontal retrace and is covered on the video/sync board. IC1 runs the sequence of 1 to 7, then 0, 32 times before any change occurs in the vertical scan decoder. This means 32 lines that are identical in vertical coding across the screen. This is accomplished by placing a fixed divide-by-32 chain between the horizontal and vertical counters.

In the case of the number 1 LDR, if light is shining on it each of the 32 lines will go white from a black screen as it scans over the column position 4 (center). When this happens 3 times, a white square is formed at the top center of your screen. When you have all your camera boards together but no optics or lenses over the LDRs, the monitor screen will light white squares in the same pattern as the LDRs are laid out on the board if

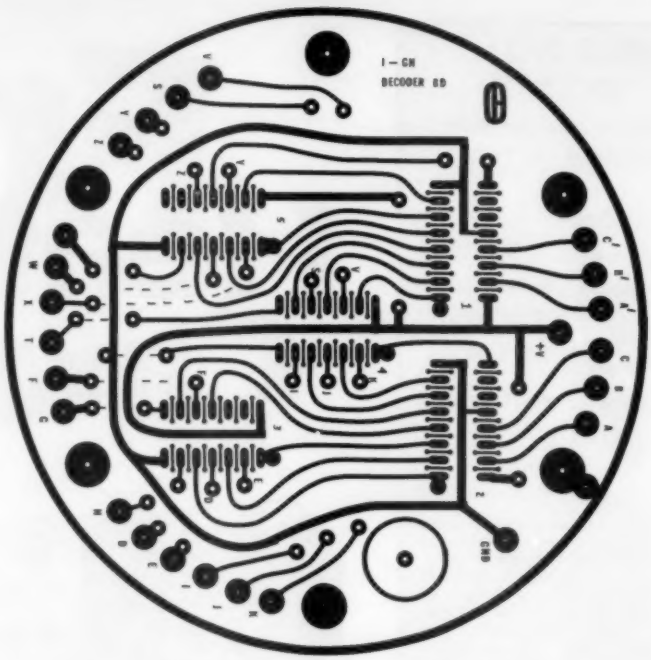


Fig. 8. Foil side of decoder board A.

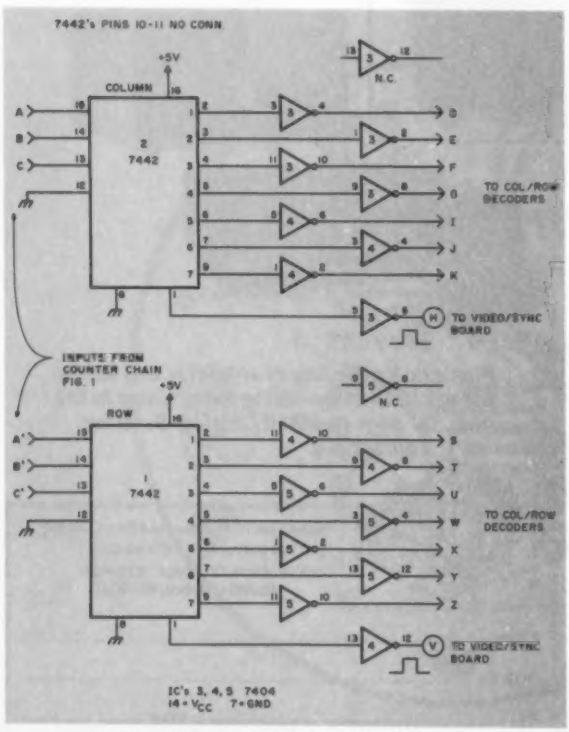


Fig. 7. Schematic of decoder board A.

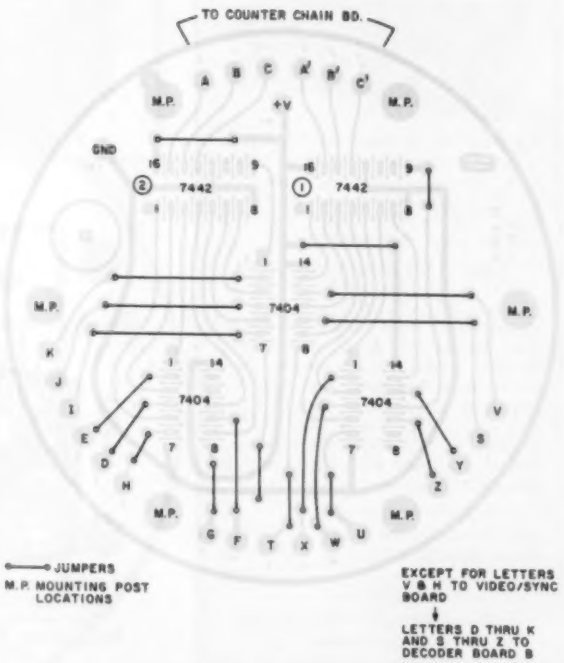


Fig. 9. Component side of decoder board A. Letters V and H are leads to video/sync board. Letters D to K and S to Z are leads to decoder board B (except V and H). Solid lines connecting dots are jumpers on component side.

☆ QUALITY parts at ☆ DISCOUNT PRICES! ☆

BSR FULLY AUTOMATIC RECORD CHANGER

- FULL SIZE CHANGER
- B.S.R. MODEL C198
- CERAMIC CARTRIDGE
- PLAYS 33, 45 & 78 RPM RECORDS....
- CUE/PAUSE LEVER
- ADJ. TRACKING FORCE

RECORD CHANGER DOES NOT INCLUDE BASE OR A.C. CORD..

$25.00 EACH 4 for $90.00

4PDT RELAY

- 14 pin style
- 3 amp contacts
- 24 volt d.c. or 120 volt a.c. coil
- Used but fully tested

$1.70 EACH

specify coil voltage

LARGE QUANTITIES AVAILABLE

SOCKETS FOR RELAY 50¢ each

COMPUTER GRADE CAPACITOR

3,600 mfd. 40VDC $1.00 — 1 3/8" DIA. X 3" HI

6,400 mfd. 60VDC $2.50 — 1 3/8" DIA X 4 1/4"

20,000 mfd. 25 VDC 2" DIA. X 2½" HIGH $2.00

22,000 mfd. 25 VDC 2" DIA X 2 1/2" HIGH $2.50

22,000 mfd. 40 VDC 2" DIA. X 5" HIGH $3.00

45,000 mfd. 25 VDC 2" DIA. X 4" HIGH $3.50

52,000 mfd. 15 VDC 2" DIA X 4 1/2" HIGH $3.00

72,000 mfd. 15 VDC 2" DIA. X 4" HIGH $3.50

CLAMPS TO FIT CAPACITORS 50¢ ea.

MINI SIZE BUZZERS

1½ to 3 volts 75¢ ea WITH WIRE LEADS

1½ to 3 volts 75¢ ea WITH PIN TERMINALS

3 to 7 volts WITH PIN TERMINALS 75¢ each

MITSUMI MODEL UES-A55F VARACTOR UHF TUNER

FREQ RANGE 470 - 889 MHZ

ANTENNA INPUT 300 OHMS

$25.00 each

10 for $220.00

16.5 VAC 1 AMP CLASS 2 XFMR

$3.00 EACH

SEND FOR *NEW* 1982 Free! 40 PAGE CATALOG Free!

TYPE N CONNECTOR

KINGS UG 536 B/U FITS RG55, RG58, RG141, RG142, RG223 SOLDER TYPE

$1.75 EACH 10 for $16.00

L.E.D.'s

STANDARD JUMBO DIFFUSED

RED 10 FOR $1.50

GREEN 10 FOR $2.00

YELLOW 10 FOR $2.00

TRANSFORMERS

120 volt primaries

6 VOLTS at 150 mA $1.25

12 V.C.T. at 500 mA $2.50

16.5 V. at 3 AMPS $6.50

18 VOLTS at 1 AMP $4.50

25.2 VCT at 2.8 AMP $5.50

FLASHER LED

5 VOLT OPERATION JUMBO SIZE 2 FOR $1.70

BI POLAR LED

2 FOR $1.70

SUB MINI LED

.079" X .098" 20mA at 1.75v 10 FOR $1.00 200 FOR $18.00

QUANTITY PRICES AVAILABLE

SUPER SMALL PHOTO-FLASH

170 MFD 330 VOLT

1 1/4" x 7/8" 2 for $1.50 10 for $7.00

CANNON XLRA-3-13 CONNECTOR

3 PRONG CHASSIS MOUNT CONNECTOR

$2.00 EACH 10 for $19.00

750 MFD 330 V PHOTO FLASH

2" HIGH X 1 1/4" DIA.

$1.25 EACH 10 FOR $11.00

RECHARGABLE SEALED LEAD-ACID BATTERIES

6 VOLTS 6 AMP/HR ⅜ X 2 X 4½ IN. $10.00

6 VOLTS 7½ AMP/HR 4½ X 2 X 4½ IN. $12.50

FLAT LEVER MINI-TOGGLE SRDT (ON-ON)

5 AMP @ 120 VAC CDK # 7105

$1.00 EACH 10 for $8.50 100 for $75.00

2" DIA. 1½VDC BUZZER SPECIAL!

50¢ each 10 for $4.00 100 for $35.00

★ SPECIAL ★ MRF 901 MICROWAVE TRANSISTOR

$2.50 EA.

2" ALLIGATOR CLIPS

7 clips for $1.00

100 clips for $12.00

500 clips for $50.00

ALL ELECTRONICS CORP.

905 S. Vermont Ave. ↙20

P.O. BOX 20406

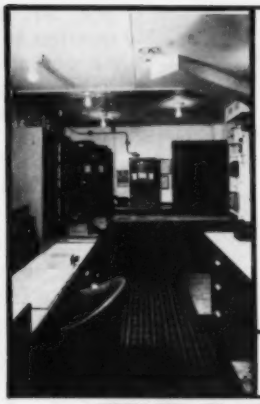
Los Angeles, Calif. 90006

(213) 380-8000

Mon. - Fri. 9 AM - 5 PM Saturday 10 AM - 3 PM

TERMS

- Quantities Limited
- Min. Order $10.00
- Add $2.50 Shipping USA
- Calif. Res. Add 6%
- Prompt Shipping



RADIO STATIONS COMMON? NOT THIS KIND is a history of communications commencing with the first visual systems, terminating in a brief description of the electronics fitted in the modern merchant ship, and centered around the largest marine radio station in Canada, Halifax Radio VCS. As a member of the Royal Canadian Navy, Metro Goldwyn Mayer Inc., Air Services Branch Department of Transport, Gypsum Transportation Ltd., Royal Canadian Mounted Police, and Canadian Coast Guard, Mr. Roscoe has enjoyed twenty-five years as a radio operator. He operates Amateur Radio Station VE1BC and is an active member of Society of Wireless Pioneers, Veteran Wireless Operators Association, Canadian Amateur Radio Federation, Nova Scotia Amateur Radio Association, Kings County Amateur Radio Club, American Radio Relay League and World Ship Society. Anyone with an interest in Amateur Radio, Ship Radio Stations, Commercial Radio Operating, Telegraphy, Aircraft, Ships, or Nova Scotia, should find this book interesting and informative. **Reserve your copy now. Send no money at this time. You will be notified of the shipping date, and will be billed at that time.**

S.G. Roscoe, Box 1, Site 5, R.R.#5, Armdale, Nova Scotia, Canada B3L 4J5, (902) 868-2343. ↙95

TALK FARTHER

. . . with range-extending products from VoCom

VoCom Power Amplifiers

Drive Level	Output Power	Model Number
150-200 mW	25W	2C025-200 mW
1.5 W	20-25W	2C025-2W
1.5W	45-50W	2C050-2W
1.5W	80-90W	2C100-2/25
2W-5W	>30W	2C025-2W
2W-5W	>50W	2C050-2W
2W-5W	>100W	2C100-2/25
10W	100W	2C100-10/25
25W	100W	2C100-2/25
25W	100W	2C100-10/25

25, 50, or 100 Watts Power — Whatever your present output level — from 200 mW hand-held on "battery saver" mode to 25W mobile or base — you can use that to drive a compact, 12V power amp from VoCom for much more talk-out power (see chart). Each model has a front panel switch to let you go "barefoot" for short hauls, plus an L.E.D. indicator to show the mode you're in. Full 10 MHz bandwidth gives you virtually unchanged power across the entire 2-meter band. High efficiency design holds down generated heat, low input VSWR saves battery drain by your radio's final amp. Use the chart to see which VoCom Power Amplifier gives you the power out you'd like from the power that you now have.

Power Pocket™ Mobile Amplifier/Charger — Simply plug in your Icom IC-2A(T) and you have a 25W synthesized mobile rig — take it out again, all charged and ready, when you want hand-held operation. Accepts any IC-2A version. Delivers 25W RF output, 2½W audio with 4" speaker to overcome road noise. Charge pocket accepts all Icom battery packs, has independent charging switch, indicator. Mic preamp makes Power Pocket compatible with any mobile microphone and with Icom speaker/mic.

5/8 HT Gain Antenna boosts reception while giving your hand-held full quieting out of spots you're nearly dead in with a rubber duck; provides excellent improvement. Only 8" telescoped, 47" extended. Better than 1.5:1 VSWR. BNC connector.

Spring-loaded 1/4 wave antenna and 4" stubby duck also available. See your favorite amateur radio dealer.

VoCom ↙90

PRODUCTS CORPORATION

65 East Palatine Road

Prospect Heights, IL 60070

(312) 459-3660

Icom and IC-2A are trademarks of Icom America Inc. Power Pocket and VoCom are trademarks of VoCom Products Corp. © 1982 by VoCom Products Corp.

↙See List of Advertisers on page 114

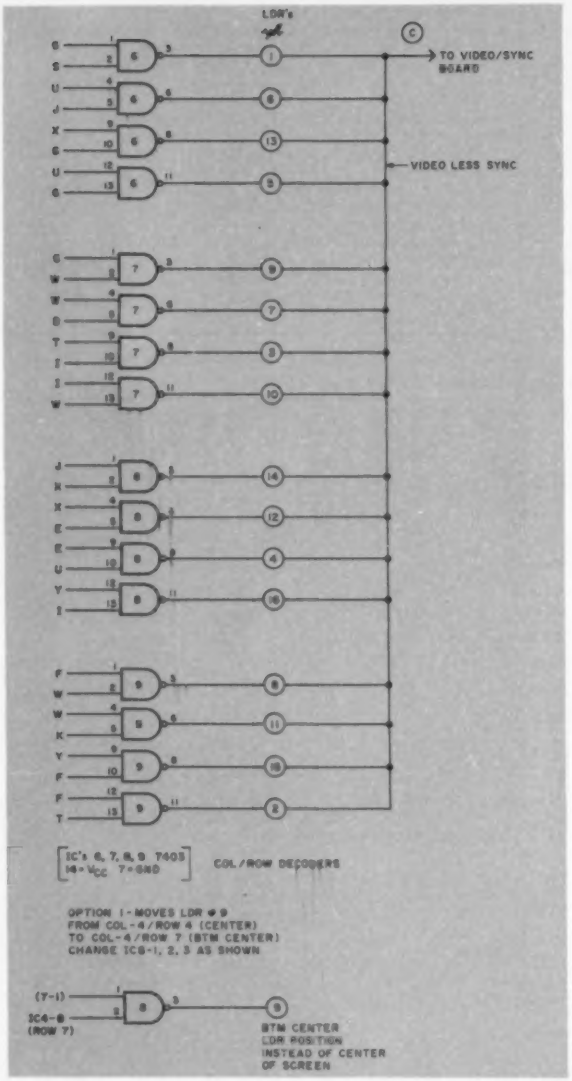


Fig. 10. Schematic of decoder board B. Option 1 moves LDR #9 from column 4/row 4 (center) to column 4/row 7 (bottom center). Change IC8 pins 1, 2, and 3 as shown, and load LDR at bottom center.

light is falling on all the LDRs. This will be a final check that all is working, before the mechanical assembly.

The row decoder (IC2) does the same job as the column divider (IC1) but at a slower rate, to handle horizontal rows. Therefore, it advances one position after each 32 horizontal lines. This happens seven times, forming 7 horizontal rows of 32 lines each. If more LDRs and decoding were used, the camera has a possible 7×7 or 49-position resolution. The complexity is not worth it, and the camera functions just fine using only 16 of these 49 possible locations. This is accomplished by allowing the focused moon image to be larger than one square of resolution and using multiple lit boxes to show where the image is relative to center screen (on target). A perfectly aimed antenna will produce a white + sign at the center of the monitor screen.

IC3, IC4, and IC5 are merely inverters to get the low 1-of-8 outputs of the 7442s back to highs that can be gated together in further TTL logic. Figs. 8 and 9 show the foil and component sides of decoder board A.

The last of the decoding occurs in Fig. 10, decoder board B, where 7403 gates are used to detect which of the 49 squares the monitor is scanning over and enable the proper LDR for that segment. Figs. 11 and 12 show the foil and component sides of decoder board B.

For the positions that have no LDRs, as you will see more clearly next on the video/sync board, there will be no LDR enabled and the video (VID) line will be at or very near +V. This +V on the VID line will represent a black screen on the monitor in the final video composite. For those squares that have an LDR sensor, each has a corresponding 7403 gate section. When the gate is enabled, the open collector output tries to pull +V down to ground through a load resistor. All the LDRs are in parallel by the video line, but only one at a time can be considered in the circuit—the one enabled by the scanning chain.

Going briefly to point C on Fig. 13, the video/sync board, you will see a 10k resistor to +V in the base circuit of the first video stage. The circuit is really a voltage divider consisting of that 10k at all times, in series with either (1) an LDR that is in series with the output transistor of its 7403 gate to ground, or (2) the 10k alone with no enabled LDR for those positions not having LDRs.

Remember, I said +V on the VID line meant a black screen. Automatically, you have 33 positions representing no LDRs and a black screen. In the 16 positions having LDRs, the LDR represents the lower resistor in a voltage divider and as such will cause the voltage at point C to be very close to +V (LDR off—no light), or very close to ground (LDR on—light shining on it). My LDRs swing from several megohms (dark) to about 400 Ohms (light). That means the voltage divider changes from (1) +V through 10k through megohms to ground, causing the junction of the 10k and LDR to be very close to +V, to (2) a series of +V through 10k through 400 Ohms, causing the junction of the 10k and LDR to be very close to ground. This junction voltage controls the base of the first video stage.

Following through the video for an example of one LDR with light on it, the VID line and point C will be low or near ground. The first video stage is just an emitter follower, so no inversion occurs and the base of the second video also will be low and the transistor at or near cutoff. When it is cutoff, the collector rises to at or near +V, and this represents white on the screen.

The last stage is also just an emitter follower to allow enough current to drive a 75-Ohm cable and the 75-Ohm load presented by either the game modulator or the video monitor input. If the monitor has a gain or video drive control, jumper A to C in the last video emitter circuit and omit the onboard gain pot, RL. If the monitor has no control or the game modulator no input gain adjust, use RL and jumper B to C to allow some means of adjusting overall composite video level.

The base of the final video stage has control from two more points that should be covered here. The two transistors with H and V for inputs are the sync mixer and make up the

final composite video. Each time the H line goes high (every horizontal line, position 0) or the V line goes high (every vertical scan or field, position 0), the base of the final video is dropped to approximately 0.2 volts, or close enough to be called ground. This is sync-voltage output in my camera.

If the video example were reversed, using a dark or absent LDR position, the second video stage can turn on only to the point where its collector is at 1.4 volts. This is caused by the two diodes in its emitter for 0.6 volts apiece and the 0.2 volts from emitter to collector on the second stage. This 1.4 volts becomes our black level, and allows for the normal video composite of sync being blacker than black. If you consider my composite video as 0.2-volts sync, 1.4 volts-black, and 5.0-volts white, then divide it down with the level control, you will end up with video composite of very close to the standard of 1.0-volt video, 0.4-volts sync. It at least seems to be close enough for a perfect picture with stable sync, and I felt that trying to get any closer was not worth the time or extra components. Foil and component layouts for the video/sync board are shown in Figs. 14 and 15.

That about completes the electronics package, and if you have a power problem, the 74Cxx equivalents can be used for all the TTL devices except the final 7403 decoders. The 555 is running well below its maximum +18 volts, but seems content and quite stable on +5 volts.

Mechanical Assembly

The area of mechanical assembly will vary, as with most ham projects, along with its uses. For that reason, I'll outline how I did mine and you can carry on or modify from there. As illustrated in Fig. 16, the housing on my camera is PVC plastic pipe! That's why all the boards are round and separated by three spacers between each board. You can, thereby, build up a board-over-board sandwich by skipping every other hole of the six given per board to set the spacers on.

Looking straight into the LDR board, it is spaced from the board below it by 3 spacers in a triangle. The next board below, by 3 in an inverted triangle, and so on. I used 4-inch i.d. black pipe, and would suggest that whatever you use be black inside to avoid light reflections and stray light. You can buy end caps for the pipe, and I used one as is on the rear of the camera. It was stuck on with rubber cement for easy removal. One hole in this cover allowed the RG-59 feedline to exit through, and a second would have to be provided if the on-board level control is used—I did not use it.

The front cover I made from another end cap, but I sawed off the entire lip from the horizontal center line down. This allowed me to add small aluminum brackets to one side. To the

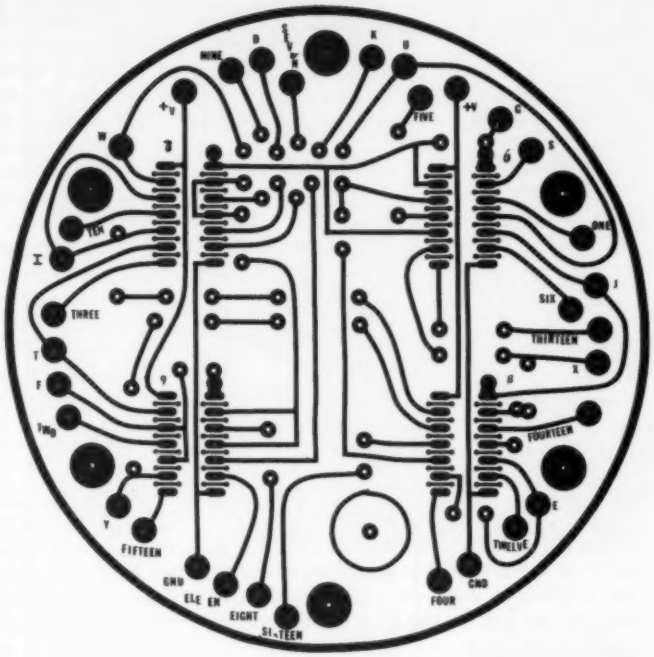


Fig. 11. Foil side of decoder board B.

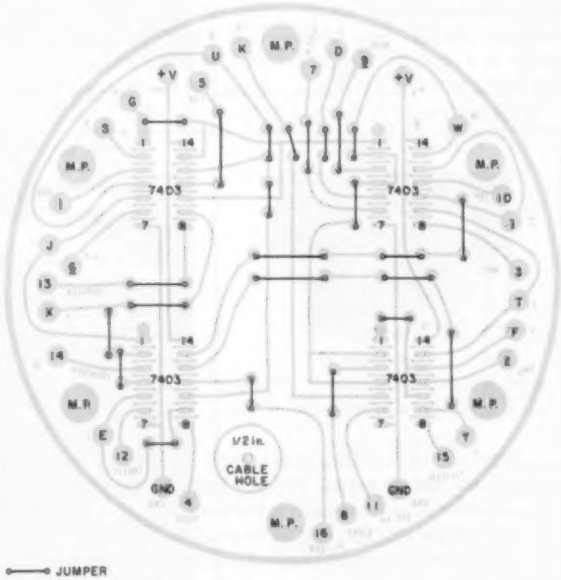


Fig. 12. Component side of decoder board B. Numbers and letters indicate proper placement of input/output leads to other boards. Solid lines connecting dots are jumper leads on component side.

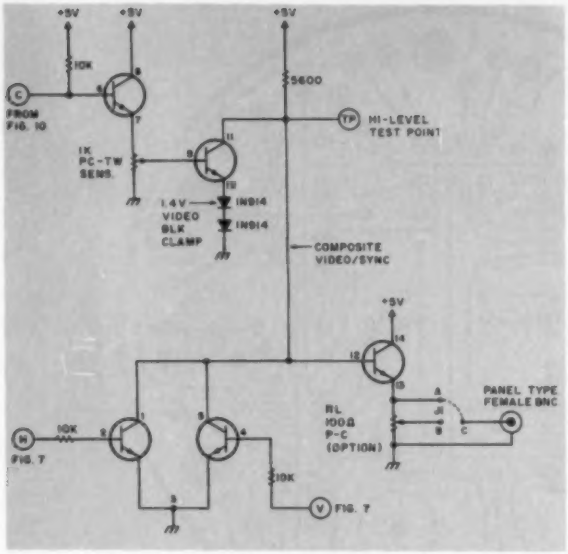


Fig. 13. Schematic of video/sync board. All transistor devices shown are small-signal NPN devices in an RCA IC, CA3046. Numbers shown around the e-b-c of devices indicate pin numbers of that IC for reference and troubleshooting. Note: If cable is terminated in 75 Ohms at the monitor or a drive-level pot (usually 50 to 100 Ohms in monitors), use J1 from A to C and omit pot RL. If no drive level is used on your monitor, jumper B to C and use RL as your drive control to prevent overload.

bracket is attached a rod that runs down the side toward the rear to a small, sealed, metal box that holds a 4-rpm dc motor I had lying around. It is much like the ones the advertising signs use, and I think it was for 6-V dc battery operation. Plus 5 volts runs it just fine, if a bit slow. This allows me to remotely rotate a "lens cover" of sorts on and off the end of the pipe to keep rain, snow, dirt, etc., out of the lens area.

On the topic of lenses, or optics, I am still trying for a better setup, but one of my prime criteria was that it be cheap. After all, I'm trying to avoid using an SSTV or FSTV monitor camera because of cost, so why use a camera lens that costs more than the system electronics? So far, the best combination I have found is with dime-store magnifying glasses with their handles removed.

I fixed-mounted one that was right at 4 inches o.d. at the center of a 6-foot piece of PCV pipe, and that allows me to slide the electronics in and out towards it from the rear. I also have a 3.5-inch lens mounted in a 4-inch collar that I can slide in and out from the front of the pipe to form a compound lens system. That is the area of experimentation at the moment, and I don't mind admitting my physics classes were too long ago. Optics was never really my bag, nor was photography, so all help offered will be gratefully accepted.

The limitation of this system would seem to be use only during full moonlight, but that depends on the response of the photo device you use and the lens system you end up with. As it stands now, I can track in some very hazy conditions, and even clouds don't confuse things too much. Next to try is a full-blown infrared system, I think!

For all the OSCAR fans who read on when the name was mentioned in paragraph one, I have not gone bananas enough to try visually tracking an OSCAR satellite with the LDR system. However, the same electronics system is being tried, mounted in the same waterproof-type housing with two full caps. The difference is that the 7403 outputs will be used to activate PIN diodes (or similar switching devices) on the downlink antenna system. I am trying to build onto the outdoor, steerable OSCAR antennas something like my Twinlead Terror antenna system (*73 Magazine*, November, 1977, p. 54), and then do the video add-on at the monitor end using the sync/white commands coming down the 75-Ohm cable. The video then would be derived from some form of the receiver agc. I mentioned this earlier, in the Twinlead Terror article (which got titled, "Cheap Ears for OSCAR").

You can do some positively wild things with scanned and electronically-steered antennas when you have only receiver power levels to worry about. It becomes even easier when you have a full-duplex, two-band arrangement like the OSCAR uplink/downlink. The receive antennas scan at a high enough rate to be above audio, so you can easily filter out the switch-rate whine. All you hear is the additive result, but each antenna's agc product is

Signal	Location	Measured Frequency
1. F_{tp}	555 IC pin 3	122.880 kHz (for H = 15,360 Hz, V = 60 Hz)
2. A	Column IC pin 12	61.440 kHz
3. B	Column IC pin 9	30.720 kHz
4. C	Column IC pin 8	15.360 kHz
5. D	÷ by IC pin 11	960 Hz
6. Q	÷ by IC pin 12	480 Hz
7. A'	Row IC pin 12	240 Hz
8. B'	Row IC pin 9	120 Hz
9. C'	Row IC pin 8	60 Hz

This has the horizontal sync running about 400 Hz low, but allows the vertical sync to be correct to avoid vertical "flutter." This is a compromise to reduce system electronics, but all sets tried pulled in easily to the lower horizontal rate. The following is a representation of the VID line with light shining on all LDRs. L is TTL low pulses. Scope Horz. rate = 1/60 sec per full horizontal scan or about 3 ms per cm on a 6-cm Horz. scale.

HHHLHHHSHHLHLHHSHLHLHLHSLHLLLHLSHLHLHLHSHHLHLHHSHHHOHHHS

H is TTL high, S is sync (app. 0.2 volts), O is option LDR 9

Table 1.

TRAC

TRAC*ONE + DELUXE CMOS KEYER

$119.95

Features: **Model TE-464**

- *True CW signal reproduction—Single signal reception
- *Removes all QRM and QRN
- *Digs out CW signal, decodes it with Phased Lock Loop Tone Decoder then reproduces it with full operator control over Gain, Freq, Tone, Delay.
- *All controls on front panel
- *Freq control variable 300 Hz to 2500 Hz will match any rig.
- *LED flashes during decoder operation
- *Operates in line with rig audio—leave in line on OFF/BYPASS
- *Built in speaker
- *Headphones jack rear panel
- *Battery or AC-adaptor, 9VDC operation

PLUS:

- *Deluxe CMOS Keyer—"State-of-the-art" CMOS circuitry
- *Self-completing dots and dashes
- *Both dot and dash memory
- *Iambic keying with any squeeze paddle
- *5-50 w.p.m.
- *Speed, Volume, Tone, Tune and Weight controls
- *Sidetone and speaker
- *Semi-auto switch for bug or straight key
- *Deluxe quarter-inch jacks for keying and output
- *Keys grid block or solid state rigs

TRAC*ONE CW PROCESSOR

$89.95

Features: **Model TE 424**

- *True CW signal reproduction—Single signal reception
- *Removes all QRM and QRN
- *Digs out CW signal, decodes it with Phased Lock Loop Tone Decoder then reproduces it with full operator control over Gain, Freq, Tone, Delay.
- *All controls on front panel
- *Freq control variable 300 Hz to 2500 Hz will match any rig.
- *LED flashes during decoder operation
- *Operates in line with rig audio—leave in line on OFF/BYPASS
- *Built-in speaker
- *Headphones jack rear panel
- *Battery or AC-adaptor, 9 VDC operation ✓76

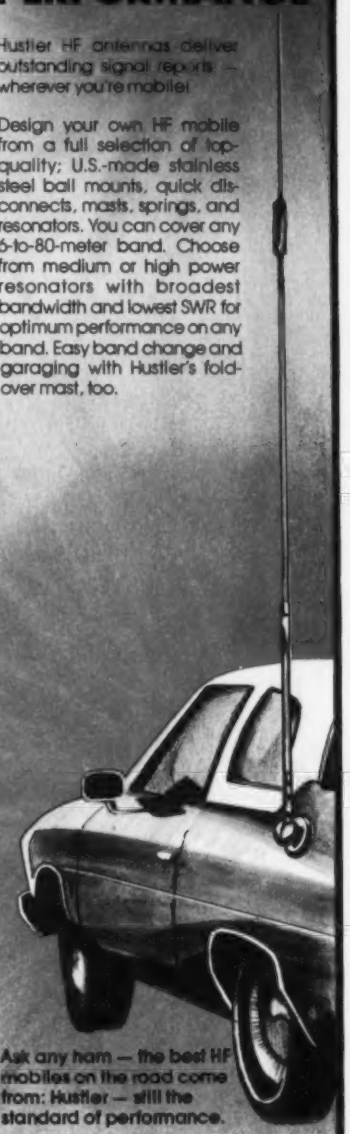
SEND FOR BROCHURE ON OUR FULL PRODUCT LINE

TRAC ELECTRONICS, INC.
1106 RAND BLDG.
BUFFALO, NY 14203
(716) 852-8188

HUSTLER
HF MOBILES DELIVER FIXED STATION PERFORMANCE

Hustler HF antennas deliver outstanding signal reports — wherever you're mobile!

Design your own HF mobile from a full selection of top-quality; U.S.-made stainless steel ball mounts, quick disconnects, masts, springs, and resonators. You can cover any 6-to-80-meter band. Choose from medium or high power resonators with broadest bandwidth and lowest SWR for optimum performance on any band. Easy band change and garaging with Hustler's fold-over mast, too.



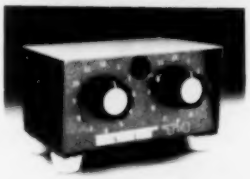
Ask any ham — the best HF mobiles on the road come from: Hustler — still the standard of performance.

HUSTLER®

3275 North "B" Avenue
Kissimmee, Florida 32741

An Amateur Company

T-1 RANDOM WIRE ANTENNA TUNER



All bands (160-10 m.) with any wire — 200W output — Any transceiver — Home or portable — Neon tune-up indicator.

Only $32.95

T-2 ULTRA TUNER

Tunes out SWR on any antenna — coax fed or random wire (160-10 meters). Any rig — up to 200 watts RF output. Rugged, yet compact: 5¼" x 2¼" x 2½".

Only $43.95

T-6 ULTRA TUNER

Most versatile antenna tuner available. Any antenna — coax fed or random wire (160-10m.). Front panel function switch selects between two circuits — a Pi or L network — or tuner bypass. Front panel antenna switch. Relative output meter. 200w output — will work with virtually any transceiver. 6½" x 3" x 3". Attractive bronze finished enclosure.

Only $64.95

T-3 MOBILE IMPEDANCE TRANSFORMER

Matches 52 ohm coax to the lower impedance of a mobile whip. Taps between 3 and 50 ohms. 3-30 MHz. 300 watts output. 2¾" x 2" x 2¼".

Only $24.95

DL-1 K4RLJ DUMMY LOAD

The DL-1 is a unique chemical dummy load. Unlike messy oil-filled dummy loads, it will not leak. Sealed ready to use. Max. 1000 watts PEP for 15 sec. SWR less than 1.5:1 1-225 MHz. Portable — only 3⅛" x 4⅜".

Only $19.95

VAN GORDEN ENGINEERING
P.O. BOX 21305
S. EUCLID, OHIO 44121

✓See List of Advertisers on page 114

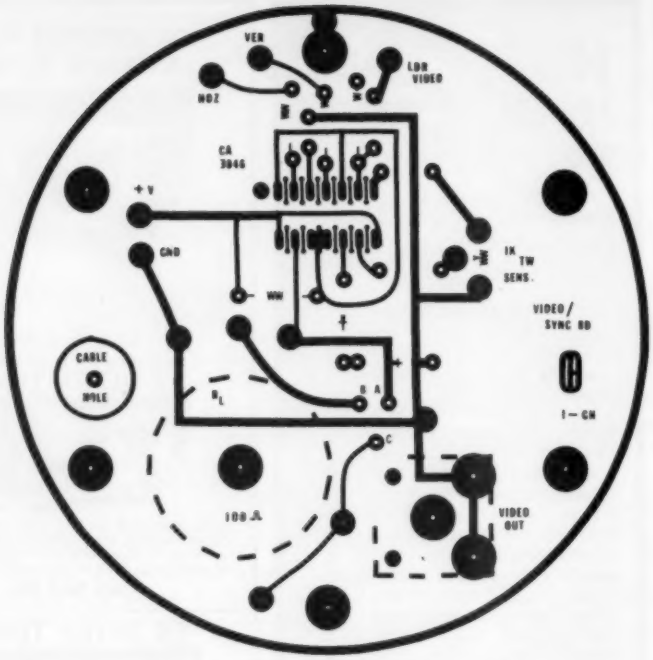


Fig. 14. Foil side of video/sync board.

sampled, and only the highest is used to light the white box on the monitor—sort of a sample, hold, choose-the-highest-figure, and use-for-display system.

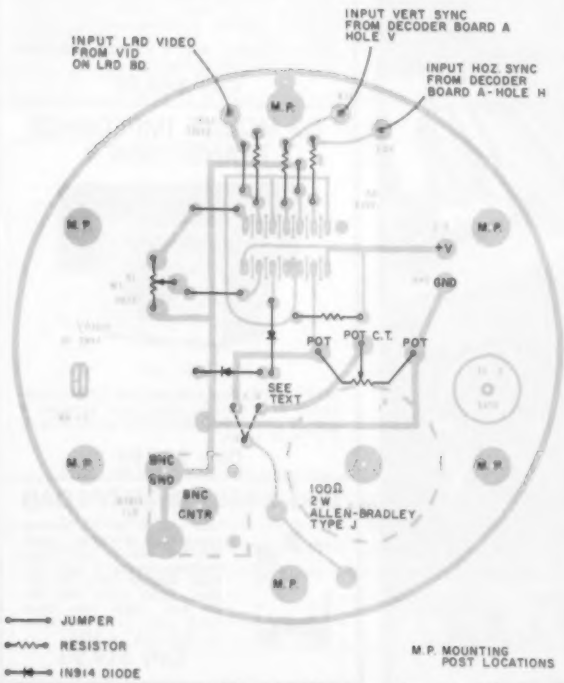


Fig. 15. Component side of video/sync board. Schematic type symbols are used to show loading placement of components. Solid lines connecting dots are jumpers on component side.

I am still deciding whether to use steer antennas to produce center-box white scheme, or sample and display all levels as boxes in the same arrangement in which the antennas are mechanically set up. The latter has the advantage of being able to tell what polarity sense the signal really is, at the antennas, by observing what box(es) are lit the brightest, and to what polarity you have those antennas aligned. It does require small changes in the video stage of the camera, however, so you don't get just saturated white or black off positions intentionally chosen for the EME arrangement.

I have tried several sample-and-hold circuits and antenna positionings so far and have found none to be the perfect result I want. Many such circuits are already around as described in the articles over the past couple of years and 10-meter antennas are easy to build, so you may have your system running before I have mine complete. I am working hard on the EME version at the moment, but should get back on the OSCAR version soon.

The cost of the A-to-D converter IC is quite attractive now, and with my love for digital circuits I am going to try one more sample-and-hold circuit using that type of device. It is an analog in, 3 digits in BCD output device covered a bit further as an antenna readout device for use with CDE Ham 3 rotator controls in *Ham Radio,* January, 1979, p. 56. The device used there is an AD 2020 by Analog Devices, Norwood, Massachusetts.

If there are any questions, please include an SASE, and I'll sure try to help you. If you come up with other uses (surveillance, etc.), please write, as several people have already approached me with ideas beyond what I had in mind. I'll try to act as a go-between as best I can for any new ideas for my camera. Good lookin'.■

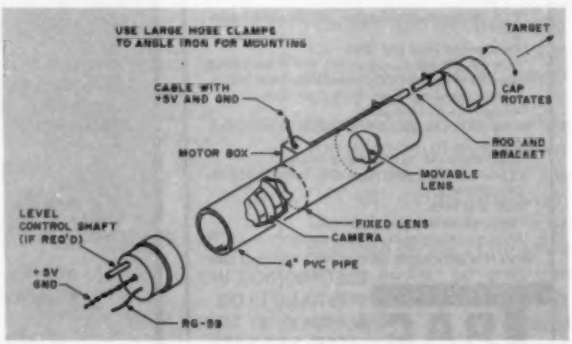


Fig. 16. Mechanical assembly of the camera.

Reader Service for facing page ←331→

The Standard for Comparison

New AZDEN® PCS-300

2-M Handheld FM Transceiver

8 MHZ COVERAGE • 142 to 149.995 MHz in 5 kHz steps, including CAP and MARS.

IDEAL SIZE & WEIGHT DISTRIBUTION • 7.3" high by 2.5" wide by 1.8" deep; 1.4 lbs.

MICROCOMPUTER CONTROL • All frequency operations are done by means of a microcomputer keyboard with acquisition tone.

LCD DISPLAY WITH TIMED LAMP • Draws almost no current. Lamp times out automatically after 20 seconds.

16 KEY AUTOPATCH • Keyboard works as a Touchtone® pad while transmitting.

PL TONE SWITCH • Actuates optional subaudible tone module.

PROGRAMMABLE "ODD SPLITS" • Transmit and receive on any possible frequency combination. Reset in seconds.

8 CHANNEL MEMORY WITH SCAN • Eight addressable channels and one externally accessible up/down channel retain frequency and standard offset. Backup drain is a scant 10 microamps!

AUTOMATIC INCLUSIVE OR EXCLUSIVE PROGRAMMABLE BAND SCAN • Limits may be reset in seconds. Scans either inside or outside the limits.

BUSY AND VACANT SCAN MODES • Scan for either an occupied or empty frequency.

KEYBOARD LOCK • Prevents accidental change of frequency or scan status.

TRANSMIT LOCK • Avoids unintentional transmission.

DIGITAL S/RF AND MEMORY ADDRESS METER • Shows relative signal strength on receive, relative power on transmit. Also shows memory address.

HIGH OR LOW POWER • 3 watts high, 1 watt low. Low power is continuously adjustable from 0.5 to 3 watts.

TRUE FM • Not phase modulation – Unparalleled audio quality.

AUTOMATIC FRONT END TUNING • RF stage is varactor tuned for superior sensitivity and selectivity.

RUGGED COMMERCIAL-GRADE MODULAR CONSTRUCTION The PCS-300 is built to take years of the toughest operating conditions.

SUPERIOR RECEIVER • Sensitivity is 0.25 uV for 20 dB quieting, 0.2 uV for 12 dB SINAD.

SNC ANTENNA CONNECTOR •

STANDARD ACCESSORIES • Heavy duty NiCAD battery pack (500 mAh), belt clip, hand strap connector, flexible rubber antenna, earphone, ac charging unit, and special stand for table-top operation.

OPTIONAL ACCESSORIES • Deluxe leather case, mobile dc charging cord, external speaker/microphone, and PL tone module.

MANUFACTURER: AZDEN JAPAN PIEZO CO., LTD. No. 12-17, 1-chome, Kami-Renjaku, Mitaka, Tokyo, Japan, Telex: Tel: 2822452

EXCLUSIVE DISTRIBUTOR: AMATEUR-WHOLESALE ELECTRONICS, INC. 5807 S.W. 129 Terrace, Miami, Florida 33176 Telephone (305) 233-3531 Telex: 80-3358 Toll-free (800) 327-3952

Mike Zedan WD8JLW
4221 Lum Road
Attica MI 48412

Technical Clinic
PO Box 636
Sterling Heights MI 48078

CQ MARS de IC-2A

—work new worlds

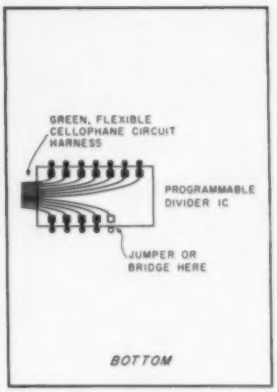


Fig. 1.

Being a group that takes pleasure in passing along useful information to fellow hams, Technical Clinic sends this public information bulletin on the 10-minute frequency modification for the new Icom IC-2A hand-held. The short and simple job will allow operation (depending on individual radio characteristics) from 141.000 MHz to 149.995 MHz.

TC was pleasantly surprised to discover that Icom has made another rig that lends itself to tinkering. This happened while one was on the bench for a product development experiment.

You will need only solder and a low-wattage soldering iron. The two-step operation is as follows:

1. De-solder the brown jumper wire from the MHz BCD thumbwheel switch. This will allow the MHz switch to run through its whole range.

2. Solder a small piece of wire (or form a solder bridge) at the position where the cellophane PC harness terminates at the programmable divider IC, as shown in Fig. 1. This allows the radio to recognize a request for 148 and 149 MHz.

That's it. You now have a radio with MARS/CAP capability which has not had any of its normal operation impaired one bit. It is hoped that all present and future owners of this rig will take full advantage of this mod once their individual warranties expire.■

NEMAL ELECTRONICS

COAXIAL CABLE SALE

This Month's Super Specials

RG8X (mini 8) 95% shield.....$14.95/100 ft.
100 ft. RG8U with PL-259 on each end....$19.95
BELDEN Coax in 100 ft. rolls
RG58U #9201.....$11.95
RG8U #9208.....$24.95
Grounding strap, heavy duty tubular braid
3/16 in. tinned copper.....10¢/ft.
3/8 in. tinned copper.....30¢/ft.
3/16 in. silver plated.....15¢/ft.

POLYETHYLENE DIELECTRIC

RG58C/U non-contaminating 96% shield.....12¢/ft.
RG213 noncontaminating 96% shield mil spec...36¢/ft.
RG174/U-mil spec 96% shield.....08¢/ft.
RG11U 96% shield 75 ohm mil spec.....25¢/ft.
RG8U 96% shield mil spec.....31¢/ft.
RG6A/U double shield 75 ohm.....25¢/ft.
RG55AU (RG223) double silver shield 50 ohm....65¢/ft.
RG58U mil spec 96% shield.....11¢/ft.

LOW LOSS FOAM DIELECTRIC

RG8U 80% shield.....18¢/ft.
RG58U 80% shield.....07¢/ft.
RG58U 95% shield.....10¢/ft.
RG59/U 100% foil shield TV type.....07¢/ft.
RG8U 97% shield 11 gage.....31¢/ft.
Rotor cable 2-18ga 6-22ga.....19¢/ft.

CONNECTORS MADE IN USA

PL-259 push-on adapter shell.....10/$3.89
PL-259 & SO-239.....10/$5.89
Double Male Connector.....$1.79
PL-258 Double Female Connector.....98¢
1 ft. patch cord w/RCA type plugs each end....3/$1.00
Reducer UG-175 or 176.....10/$1.99
UG-255 (PL-259 to BNC).....$3.50
Elbow (M359) Silver Plated.....$1.79
F59A (TV type).....10/$1.99
UG 21D/U Amphenol Type N Male for RG8.....$3.00
Double Female N Chassis Mt. UG-30.....$4.75
3/16 inch Mike Plug for Collins etc.....$1.25

Connectors—shipping 10% add'l. $1.50 minimum

Cable—shipping $3.00 1st 100 ft., $2.00 each add'l 100 ft.

FREE CATALOG
COD add $1.50—FLA. Res. add 4% Sales Tax

5685 SW 80th. Street Dept. 4X Miami, Fl. 33143 Call (305) 661-5534
Come See Us At The Tropical Hamboree Feb 6th. & 7th.

412

THEY TALK

Spies...
Smugglers...
Pirate Stations...
Secret Police...
Foreign Agents...

YOU LISTEN

★ Miniature Active Antennas
★ Scanner Signal Boosters
★ Frequency Converters
★ Frequency Lists
★ Antenna Tuners
★ Code Breakers

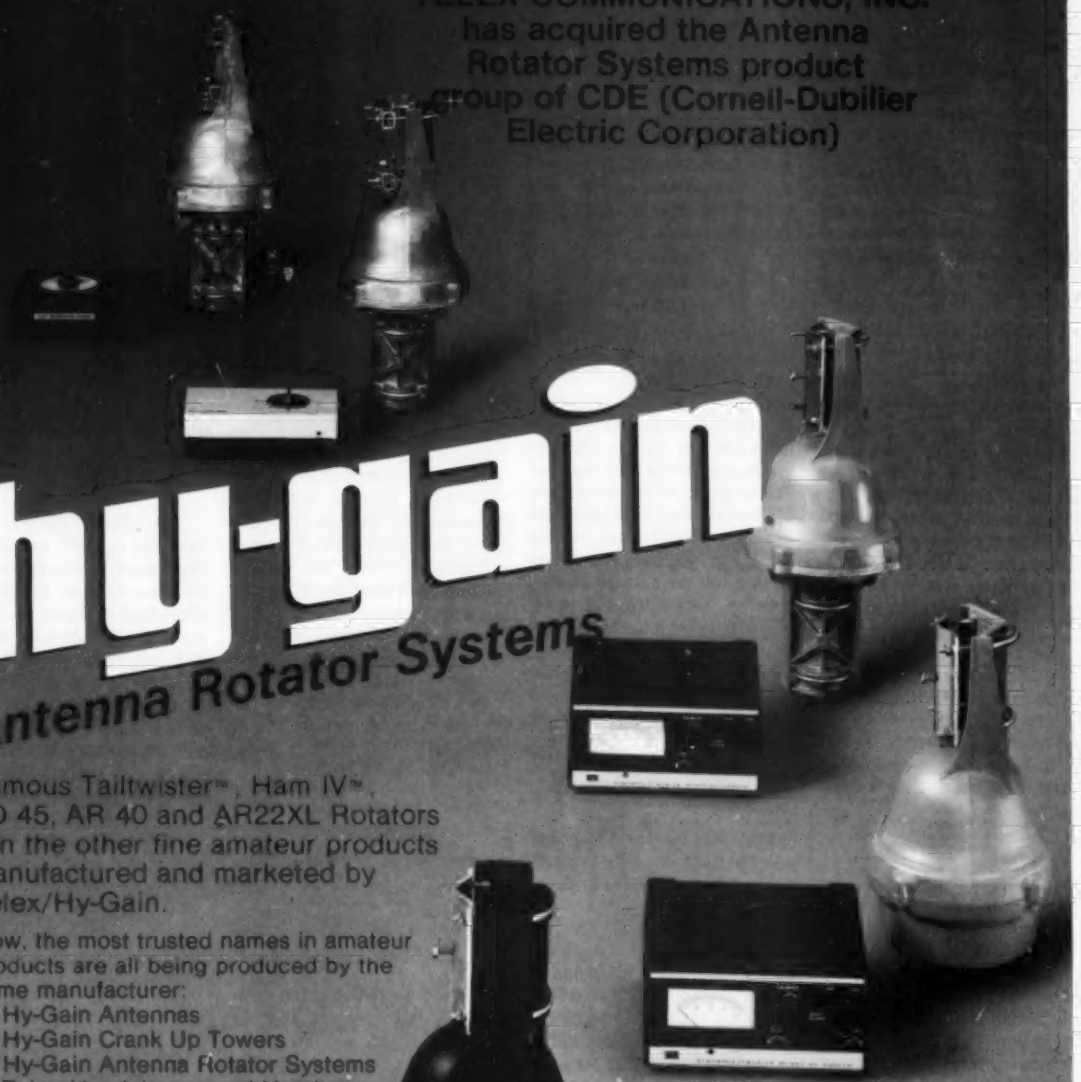
■ Low cost
■ Fully guaranteed

GROVE

FREE CATALOG
For more information write:
GROVE ENTERPRISES
Department C
Brasstown, N.C. 28902

ANNOUNCING

TELEX COMMUNICATIONS, INC.
has acquired the Antenna
Rotator Systems product
group of CDE (Cornell-Dubilier
Electric Corporation)



hy-gain

Antenna Rotator Systems

Famous Tailtwister™, Ham IV™, CD 45, AR 40 and AR22XL Rotators join the other fine amateur products manufactured and marketed by Telex/Hy-Gain.

Now, the most trusted names in amateur products are all being produced by the same manufacturer:

- Hy-Gain Antennas
- Hy-Gain Crank Up Towers
- Hy-Gain Antenna Rotator Systems
- Telex Headphones and Headsets
- Turner Microphones

Attention Dealers

Effective Immediately:
Please address all correspondence and inquiries regarding CDE Antenna Rotator Systems to the central marketing office of Telex/Hy-Gain Amateur Products.

TELEX hy-gain

310 TELEX COMMUNICATIONS, INC.
9600 Aldrich Ave. So., Minneapolis, MN 55420 U.S.A.
Europe: 22, rue de la Légion-d'Honneur, 93200 St. Denis, France

Amateur Antennas, Towers, Rotators, Microphones and Headsets—heard the world 'round.

See List of Advertisers on page 114

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

ARLINGTON HEIGHTS IL
FEB 7

The Wheaton Community Radio Amateurs will hold their annual hamfest on February 7, 1982, beginning at 8:00 am at the Arlington Park Race Track EXPO Center, Arlington Heights IL. Tickets are $3.00 at the entrance and $2.50 in advance. There will be free flea-market tables, expanded floor space, parking, awards, and a large commercial area, including the new computer section. Talk-in on 146.01/.61 and 146.94. For commercial info, call WB9TTE at (312)-766-1684; for general info, call WB9PWM at (312)-629-1427. For tickets, send an SASE to WCRA, PO Box QSL, Wheaton IL 60187.

TRAVERSE CITY MI
FEB 13

The Cherryland Amateur Radio Club will hold its ninth annual Swap 'N Shop on Saturday, February 13, 1982, from 8:00 am through 2:30 pm at the Immaculate Conception Middle School gymnasium, 218 Vine Street, Traverse City MI. General admission is $2.50 and single tables are $3.00. Talk-in on 146.85 and 146.52. For further information, contact Jerry Cermak K8YVU, Chairman, 3905 Slusher Road, Traverse City MI 49684. An SASE will be appreciated.

MARLBORO MA
FEB 14

The Algonquin Amateur Radio Club will hold an electronics flea market on February 14, 1982, at the Marlboro Junior High School cafeteria, Marlboro MA. Sellers will be able to set up from 9:00 am to 10:00 am and doors will be open from 10:00 am until 2:00 pm. Admission is $1.00. Tables are $5.00 if a written reservation is made before February 7, 1982, and $7.50 for any tables remaining after that date. Refreshments will be available. Talk-in on .01/.61 and .52. For reservations, contact Mac W1BK, 128 Forest Avenue, Hudson MA 01749.

MANSFIELD OH
FEB 14

The Mid-Winter Hamfest/Auction will be held on Sunday, February 14, 1982, at the Richland County Fairgrounds, Mansfield OH. Doors will open to the public at 8:00 am. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. Features will include prizes, an auction, and a flea market, all in a large heated building. Talk-in on 146.34/.94. For additional information, advance tickets, and/or tables, send an SASE to Harry Frietchen K8HF, 120 Homewood Road, Mansfield OH 44906, or phone (419)-529-2801.

VERO BEACH FL
FEB 20

The Treasure Coast Hamfest will be held on February 20, 1982, at the Vero Beach Community Center, Vero Beach FL. Admission is $2.00 in advance and $2.50 at the door. Features will include prizes, drawings, a QCWA luncheon, and tailgating. Talk-in on 146.13/.73, 146.52/.52, 146.04/.64, and 222.34/223.94. For additional information, write PO Box 3088, Beach Station, Vero Beach FL 32960.

FAYETTEVILLE WV
FEB 21

The Plateau Amateur Radio Association will hold its fourth annual hamfest on Sunday, February 21, 1982, at the Memorial Building, Fayetteville WV. The doors will open at 9:00 am. Admission is $2.50 and children will be admitted free. Flea market tables are $2.00. All activities will be indoors and will include ARRL displays, forums, exhibits, door prizes, and women's programs. Hot food, refreshments, and free parking will be available. Talk-in on .19/.79 or .52. For more information, contact Bill Wilson WA8YTM, 302 Central Avenue, Apartment 2, Oak Hill WV 25901, or phone (304)-469-9910 or (304)-469-9313.

LANCASTER PA
FEB 21

The Lancaster Hamfest will be held on Sunday, February 21, 1982, at the Guernsey Pavilion, located at the intersection of Rtes. 30 and 896, east of Lancaster PA. Doors will open at 0800. General admission is $3.00; children and XYLs admitted without charge. Each 8-foot space with a table is $5.00 (limited to two tables for noncommercial use and six tables for commercial use). All inside spaces are by advance registration only, and the registration deadline is February 10, 1982. All vendors must set up between the hours of 0600 and 0800; reservations will not be held past 0900 hours without prior arrangement. There will be free tailgating in specified areas outside (if weather permits) on a first-come, first-served basis. Food will be served at the hamfest. Talk-in on 146.01/.61 or 146.52. For advance registration or more information, write SERCOM, Inc., PO Box 6082, Rohrerstown PA 17603.

ELKIN NC
FEB 21

The fifth annual Elkin Winter Hamfest will be held on Sunday, February 21, 1982, at the Elkin National Guard Armory, located one mile from Interstate 77 at exit 85, Elkin NC. Breakfast and lunch will be served at the hamfest by the Foothills ARC of Wilkesboro NC and the Briarpatch ARC of Galax VA. Talk-in on 144.77/145.37, 146.22/146.82, and 146.52. For table reservations, ticket inquiries, or other information, contact Earl Day WB4GQP, 131 Harris Avenue, Elkin NC 28621, or phone (919)-835-3509.

MORRIS PLAINS NJ
FEB 25

The Split Rock Amateur Radio Association will hold its annual equipment auction on Thursday, February 25, 1982, at the Morris Plains VFW Post #3401, located on Route 53 in Morris Plains NJ. Doors will open at 7:00 pm to unload and inspect equipment and the auction will get underway at 8:00 pm sharp. Admission is free. Please limit your items to working electronic equipment—no junk—and make sure any loose parts are bagged or boxed. The club will take a flat 10% commission on all sales of individual items up to $50. Above $50, the club will take a $5.00 commission on each individual sale. All commissions are payable in cash only. There will be refreshments available and the site has plenty of parking. In case of inclement weather, the auction will be held on Thursday, March 4, 1982, at the same location and times. The Morris Plains VFW Post is located approximately 1 mile north of the intersection of Routes 202 and 53 in Morris Plains NJ. For more information, write PO Box 3, Whippany NJ 07981.

GLASGOW KY
FEB 27

The annual Glasgow Swapfest will be held on Saturday, February 27, 1982, beginning at 8:00 am CST at the Glasgow Flea Market Building, 2 miles south of Glasgow on Highway 31E. Admission is $2.00 per person with no extra charge for exhibitors. One free table will be provided per exhibitor with extra tables available at $3.00 each. There will be a large heated building with plenty of free parking. No meetings or forums will be held—just door prizes, free coffee, and a large flea market. Talk-in on 146.34/.94 or 147.63/.03. For additional information, contact Bernie Schwitzgebel WA4JZO, 121 Adairland Ct., Glasgow KY 42141.

VIENNA VA
FEB 28

The Vienna Wireless Society will hold the 9th annual ARRL-approved WINTERFEST™ '82 on February 28, 1982, beginning at 8:00 am at the Community Center, 120 Cherry Street, Vienna VA. Tickets are $3.00 and include one chance for the prize drawing. Prizes will include a Kenwood TS-830S HF transceiver, an Icom IC-25A 25-W mobile 2-meter rig, and a Santec HT-1200 hand-held, as well as accessories and books. Excellent food service will be available. Featured will be dealers' and manufacturers' displays, an indoor flea market, and outdoor frostbite tailgating. Tables are

$5.00 and $10.00. Talk-in on .31/.91 and 146.52. For additional information, send an SASE to WINTERFEST™ '82, Vienna Wireless Society, PO Box 418, Vienna VA 22180, or phone Ray Johnson at (703)-938-8313.

DAVENPORT IA
FEB 28

The Davenport Radio Amateur Club will hold its 11th annual hamfest on Sunday, February 28, 1982, from 8:00 am to 4:00 pm in the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th Street, Davenport IA. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 each, with a $2.00 charge for an electrical hookup (limited number). Hotel discounts, food, and drinks will be available. Talk-in on 146.28/.88, W0BXR. For advance tickets and table reservations, write Dave Johannsen WB0FBP, 2131 Myrtle, Davenport IA 52804.

LAPORTE IN
FEB 28

The LaPorte Amateur Radio Club Winter Hamfest will be held on Sunday, February 28, 1982, at the Civic Auditorium, LaPorte IN, beginning at 8:00 am Chicago time. The donation is $2.50 at the door and reserved tables are $2.00 each. For reservations, write PO Box 30, LaPorte IN 46350.

AKRON OH
FEB 28

The Cuyahoga Falls Amateur Radio Club will hold its 28th annual electronic equipment auction and flea market on Sunday, February 28, 1982, from 8:30 am to 4:00 pm at North High School, Akron OH. Tickets are $2.00 in advance and $2.50 at the door. Sellers may bring their own tables or rent a table for $2.00. There is plenty of space and lots of free parking. Prizes include a Kenwood TS-130S, an Icom 3AT, and an Icom 2AT. A 16K TRS-80 Model III will be raffled at $2.00 per chance. Talk-in on 146.04/.64. For more details, contact CFARC, PO Box 6, Cuyahoga Falls OH 44222, or phone K8JSL at (216)-923-3830.

LIVONIA MI
FEB 28

The Livonia Amateur Radio Club will hold its 12th annual LARC Swap 'n Shop on Sunday, February 28, 1982, from 8:00 am to 4:00 pm at Churchill High School, Livonia MI. There will be plenty of tables, door prizes, refreshments, and free parking. Talk-in on 146.52. Reserved table space of 12-foot minimum is available. For further information, send an SASE (4 × 9) to Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

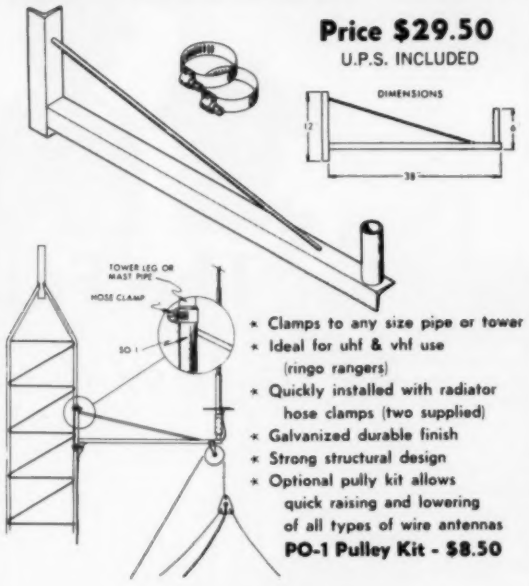
PHILADELPHIA PA
MAR 7

The Penn Wireless Association, Inc., will hold its Tradefest '82 on Sunday, March 7, 1982, at the National Guard Armory, Southampton Road and Roosevelt Boulevard (Rte 1), 2 miles south of exit 28 on the Pennsylvania Turnpike, Philadelphia PA. General admission is $3.00 and a 6'×8' seller's space is $5.00 (bring table) with an additional $3.00 for a power connection (limited number). There will be prizes, displays, refreshments, rest areas, and surprises. Talk-in on 146.115/.715 and .52. For additional information, contact Mark J. Pierson KB3NE, PO Box 734, Langhorne PA 19047.

WINCHESTER IN
MAR 14

The Randolph Amateur Radio Association will hold its 3rd annual hamfest on Sunday, March 14, 1982, from 8:00 am to 5:00 pm at the National Guard Armory, Winchester IN. Tickets are $2.00 in advance and $3.00 at the door. Table space is $2.50 and table space with table is $5.00. Setup times are 6:00 pm to 8:00 pm on Saturday and 6:00 am to 8:00 am on Sunday. For reservations or additional information, contact RARA, PO Box 203, Winchester IN, or phone W9VJX at (317)-584-9361.

MODEL
SO-1 UNIVERSAL ANTENNA STANDOFF



Price $29.50
U.P.S. INCLUDED

* Clamps to any size pipe or tower
* Ideal for uhf & vhf use (ringo rangers)
* Quickly installed with radiator hose clamps (two supplied)
* Galvanized durable finish
* Strong structural design
* Optional pully kit allows quick raising and lowering of all types of wire antennas

PO-1 Pulley Kit - $8.50

IIX EQUIPMENT Ltd. ✓474
P. O. BOX 9 OAK LAWN, IL 60453-0009
DEALER INQUIRES INVITED (312) 424-7007 MADE IN U.S.A.

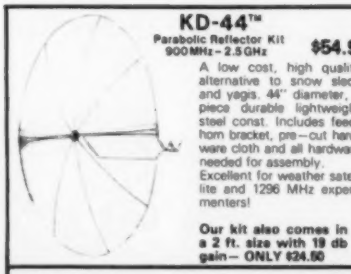
YAESU FT 207 R
ADJUSTABLE AUTOMATIC RESUME SCAN PCB

SAVE MONEY—Add the auto scan PCB to your FT-207R now and scan Memory and the band like the new transceivers, with Automatic Scan Restart on "ACTIVE" channel. Also, you can now set the listening time to suit your own desires, and change it later again and again.

FEATURES:
* Adjustable scan rate—Scan for "BUSY" channel—Set scan to restart automatically in 4 to 12 seconds after channel becomes "ACTIVE".
* Scan Restarts—Immediately with carrier drop—NO MORE WAITING.
* Hold Scan Feature—On any active channel—Automatic Scan Restart
* No PCB changes in transceiver—Simple Installation—Four wires/One transistor
* Scan entire band in approximately 25 seconds
* PCB built and tested
* Many more features
* Order WAF PCB S-1. Include $1.20 shipping and handling. NYS residents include 4% Sales tax.

WAF PCB S-1 $29.95 ✓94

QRZ SCAN INC.
11 Pleasant Drive, Rome, New York 13440



KD-44™
Parabolic Reflector Kit
900 MHz - 2.5 GHz **$54.95**

A low cost, high quality alternative to snow sleds and yagis. 44" diameter, 2 piece durable lightweight steel const. Includes feedhorn bracket, pre-cut hardware cloth and all hardware needed for assembly. Excellent for weather satellite and 1296 MHz experimenters!

Our kit also comes in a 2 ft. size with 19 db gain— ONLY $24.50

AMATEUR KITS

2300 MHZ CONVERTER KIT $36.00
Includes PC board, parts & instruction manual.

SELECTIVE PREAMP $44.50
For use with above converter. This preamp can also be used with other manufacturer's boards for improved performance.

VARIABLE POWER SUPPLY $24.95
Includes all components, case, overlays, and built in antenna switch.

DELUXE 2300 MHZ CONVERTER KIT $99.95
Recommended for experienced kit builders. Dual-stage selective preamp, mixer, i.f. amplifier and no-drift crystal-controlled oscillator.

12V STATIONARY POWER SUPPLY $24.95
For use with Deluxe Converter. Send 50c for product brochure.

COMING SOON
1691 MHZ WEATHER SATELLITE CONVERTER KIT HOME TVRO STATION WITH POLAR MOUNT

TERMS: Check, Money order, Visa, MasterCard and C.O.D. (Add $2). Allow two weeks clearance on checks. Shipping and handling charges C.O.D. by UPS or parcel post unless pre-paid with bank cards. All prices subject to change without notice.

PHONE ORDERS WELCOME

TEXAS MICROTRONICS
P.O. BOX 14116
ARLINGTON, TEXAS 76013
817-860-5440 ✓328

✓See List of Advertisers on page 114

The Father of FM

— the tragic story of Major E. H. Armstrong

Armstrong in WWI uniform. (Photo by Bradley B. Hammond)

Jeanne Hammond

Atop the Palisades at Alpine, New Jersey, across the Hudson River from Yonkers, stands a tall,

Armstrong's radio tower atop the Palisades at Alpine, New Jersey, as seen from Yonkers. (Photo by Jeanne Hammond)

three-armed tower. It is accepted as part of the landscape by those who live on the river's east bank and is seen daily by thousands of commuters on Conrail's Hudson Division trains, yet few know what this tower is or how it has affected their lives.

The tower and its accompanying radio station were built in 1938 at a cost of over $300,000 by Edwin Howard Armstrong, pioneer radio inventor, to demonstrate the superiority of his new system of radio broadcasting—frequency modulation (FM). After Promethean battles with the broadcasting industry, which fought to preserve its investment in the established system (amplitude modulation—AM), FM was finally accepted and today is the preferred system in radio, the required sound in TV, and the basis for mobile radio, microwave relay, and space communications.

As little known as the significance of the tower is the man who built it. Armstrong was born in New York City in 1890. When he was twelve years old, the family moved to 1032 Warburton Avenue—known to family and friends simply as "1032"—in Yonkers. The house, which still stands just up from the Greystone railroad station, was declared an historical landmark in 1978 by the Yonkers Historical Society.

Next door, on the north side of the house at the corner of Odell Avenue, was 1040 Warburton Avenue, the home of Armstrong's maternal grandparents. The members of the two families were a gregarious lot, and Howard's childhood was a happy one filled with large gatherings of relatives, many of whom were teachers. Learning was prized. "Quick, boy! How much is nine times five, minus three, divided by six, times two, plus nine?" His great uncle, Charles Hartman, principal of New York City Public School 160, would quiz his nephew to encourage his mental agility.

Howard Armstrong, about six years old, with his sister, Ethel.

When Howard was fourteen years old, his father, who was American representative of the Oxford

1032 Warburton Avenue, Armstrong's boyhood home in Yonkers. His earliest experiments were carried out in the cupola on the third floor.

His bedroom/workroom in the cupola looked out on the spot on the Palisades where his radio station would later be. (Photo by Bradley B. Hammond)

University Press, bought him (on one of his yearly trips to London) a book, *The Boy's Book of Inventions.* Reading of Guglielmo Marconi's sending of the first wireless message across the Atlantic so excited his imagination that he determined then and there to become an inventor.

In his attic room in the cupola overlooking the Hudson River, Howard Armstrong began tinkering with radio. In those days, broadcast sound consisted of Morse code signals picked up with earphones. The incipient young inventor set out to make them louder. He was dogged in his search and developed at this early age a capacity for infinite patience in his experiments which was to mark his life's work. "Genius is one percent inspiration and ninety-nine percent perspiration," he

Armstrong constructed large antenna kites which he flew from the upper stories of "1032" in an attempt to improve reception.

The young inventor at work on the "1032" pole.

used to say in later years, quoting Thomas Edison.

Armstrong explored many paths in his attempts to strengthen the sound. Reaching up into the air to better catch the broadcast signals, he flew from the upper stories of 1032 large antenna kites which he had built with the help of his Yonkers friend, Bill Russell. He built a 125-foot antenna pole, the tallest in the area, in the south yard. His younger sister, Edith ("Cricket"), helped in the construction, holding the guy wires and handing him buckets of paint as he swung aloft in a boatswain's chair. Neighbors watched with awe and apprehension. His mother, however, had complete faith in her son. When a neighbor telephoned to say that Howard was at the top of the pole and it made her nervous to watch, "Don't look, then," was her confident reply.

Howard attended Public School 6 in Yonkers and Yonkers High School, and went on from there to Columbia University, commuting on a red motorcycle his father had given him as a high school graduation present. His interest in radio led him to the study of electrical engineering.

In his junior year at Columbia, Armstrong's diligent search for improved radio reception paid off. He invented the regenerative-oscillating, or feedback, circuit which greatly increased radio signals, made them loud enough to be heard across a room and led the way to transatlantic radio telegraphy. His sister, Ethel, remembers vividly the night it happened. "Mother and Father were out playing cards with friends and I was fast asleep in bed. All of a sudden Howard burst into my room carrying a small box. He danced round and round the room shouting, 'I've done it! I've done it!' I really don't remember the sounds from the box. I was so groggy, just having been wakened. I just remember how excited he was."

Major Armstrong's sister, Ethel, and her husband, Bradley Hammond, listen to a crystal set with their evening meal, around 1920. (Photo by Bradley B. Hammond)

Later, another inventor, Lee DeForest, challenged Armstrong's priority for this discovery and the issue was twice argued before the US Supreme Court—which found in DeForest's favor. However, the scientific community has always credited Armstrong for the invention and he received a gold medal for it from the

Thomas J. Styles, Armstrong's longtime associate, Ethel, Howard, and his mother. (Photo by Bradley B. Hammond)

Billboard in Yonkers dating around 1921. (Photo by Bradley B. Hammond)

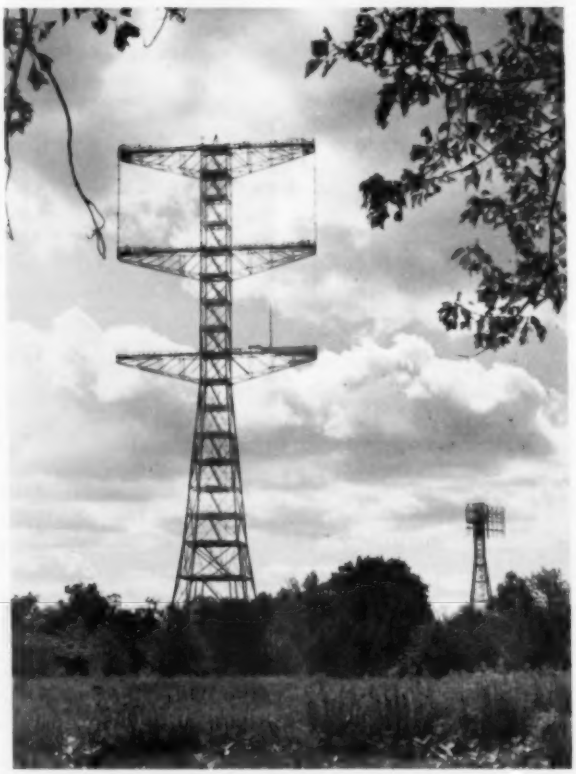
stitute in Philadelphia, also credited him with the invention of the regenerative circuit.

After graduation from Columbia in 1913, Armstrong worked as an instructor at the college. When the US entered the war in 1917, he joined the Army Signal Corps and rose to the rank of Major—his preferred title for the rest of his life. While in the service, he invented the superheterodyne circuit which amplified even further the sound of radio transmission. This invention brought him into contact with David Sarnoff, who later became President of Radio Corporation of America and whose bright and attractive secretary, Marion MacInnis, he later married.

After the war, Armstrong returned to Columbia where he worked as an assistant to Professor Michael I. Pupin, famed physicist and inventor. When Pupin

Armstrong and his wife, Marion, by the "1032" pole. (Photo by Bradley B. Hammond)

Institute of Radio Engineers. Years later, the report accompanying the presentation to him of the Franklin Medal, by the Franklin In-



Close-up of the tower. (Photo by Bradley B. Hammond)

the ALL NEW tempo S-15.

...more radio ...less money

TEMPO'S ALL NEW S-15 SYNTHESIZED HAND HELD OFFERS IMPORTANT FEATURES AT A PRICE THAT DEFIES COMPARISON.

Compare these features with any other hand held available... the S-15 is the obvious choice

- ✲ **5 WATT OUTPUT (1 watt low power switchable)**
- ✲ **"EASY REMOVE" BATTERY PACK**
- ✲ **1 HOUR QUICK CHARGE BATTERY SUPPLIED (450 ma/HR)**
- ✲ **BNC ANTENNA CONNECTOR & FLEX ANTENNA**
- ✲ **EXTREMELY EASY TO OPERATE**
- ✲ **PLUG FOR DIRECT 13.8 VOLT OPERATION**
- ✲ **3 CHANNEL MEMORY. (1 channel permits non-standard repeater offsets. 200 micro amp memory maintenance (standby)).**
- ✲ **VERY SMALL AND LIGHT WEIGHT (only 17 ounces)**
- ✲ **10 MHz FREQUENCY COVERAGE: 140-150 MHz (150-160 for export customers)**
- ✲ **AMPLE SPACE FOR PROGRAMMABLE ENCODER**
- ✲ **SPEAKER/MICROPHONE CONNECTOR**
- ✲ **ELECTRICALLY TUNED STAGES (receiving sensitivity and output power are constant over entire operating range)**
- ✲ **LOW PRICE...$289** S-15 with touch tone pad...$319

SUPPLIED ACCESSORIES:
Rubber antenna • Standard charger • Ear phone • Instruction manual • 450 ma/HR battery (quick charge type)

OPTIONAL ACCESSORIES:
1 hour quick charger (ACH 15) • 16 button touch tone pad (S15T) • DC cord • Solid state power amplifiers (S-30 & S-80) • Holster (CC15) • Speaker/mike (HM 15)

Tempo S-4
The first 440 MHz hand held and still a winner...offers the perfect way to get into an uncrowded band. Check one out at your local Tempo dealer or write Henry Radio. $289 S-4T...$319

NEW REDUCED PRICE!

Boost the power of your hand held or mobile unit with a Tempo solid state power amplifier. A broad range of power outputs available at very affordable prices. Please write for literature.

COMMERCIAL HAND HELDS
Henry Radio offers a fine line of UHF and VHF hand held transceivers for commercial applications. The operating frequency of the FMH-12 and FMH-15 is 135 to 174 MHz and the FMH-40 and FMH-44 is 440 to 480 MHz. They are extremely sturdy, their superb dependability has been thoroughly proven and the price is much lower than you might expect. Please call for complete information.

Tempo M1
Tempo does it again! This time with the world's first and only ALL CHANNEL synthesized hand held marine transceiver. The Tempo M1 operates on all marine channels...both U.S. and international, plus four weather channels. This is a real working tool and a hobby rig with hundreds of uses. It is skillfully engineered and built to provide endless hours of hard use. 1 watt low power—2½ watts high power positions. And the price...LESS THAN $500.

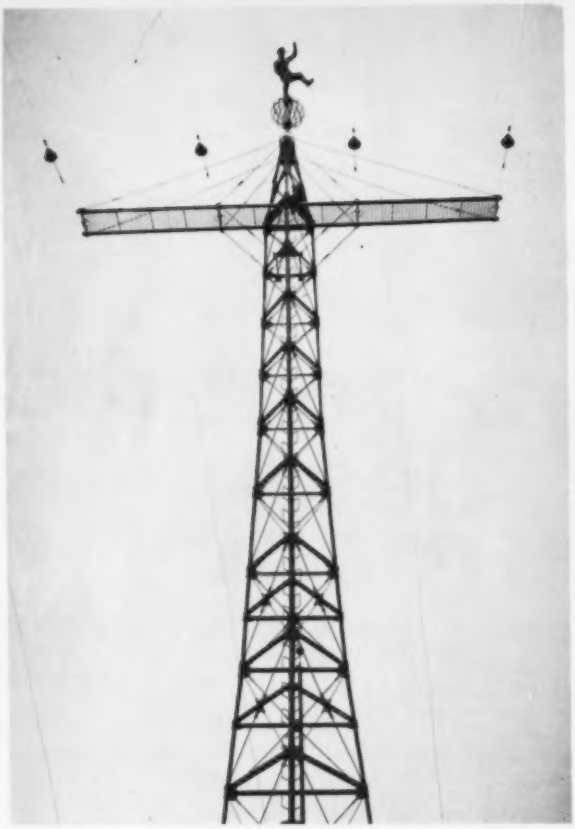
Available from Tempo dealers and **Henry Radio** ↵ 34

HENRY RADIO 54 YEARS OF SERVICE

2050 S. Bundy Dr., Los Angeles, CA 90025 **(213) 820-1234**
931 N. Euclid, Anaheim, CA 92801 **(714) 772-9200**
Butler, Missouri 64730 **(816) 679-3127**

NEW TOLL FREE ORDER NUMBER: (800) 421-6631
For all states except California.
Calif. residents please call collect on our regular numbers.

↵ See List of Advertisers on page 114



In 1923, to celebrate the opening of New York's first radio station—and to impress his fiancee—Armstrong cavorted atop the new WJZ transmitter tower. (Photo by George Burghard)

Armstrong receives the Medal of a Chevalier de la Legion d'Honneur *for his contributions to wartime wireless, from General Ferrie, head of French military communications.*

died, Armstrong took over his professorship and, financing his own research—his inventions had by now made him wealthy—concentrated on the elimination of static.

In 1933, Armstrong secured four patents which were to be the basis for frequency modulation. This was an entirely new system of broadcasting. Unlike amplitude modulation which varies the amplitude or power of radio waves to transmit sound, frequency modulation varies the number of waves per second over a wide band of frequencies. As static is transmitted by amplitude modulation and cannot break into the wide band of frequencies of frequency modulation, the latter is virtually static-free. Armstrong, who enjoyed aphorisms, liked to quote defeatists who said, "Static, like the poor, will always be with us." He proved them wrong.

The first public broadcast of FM was made in 1935 from the home of his friend C.R. (Randy) Runyon at 544 North Broadway in Yonkers. Runyon was a ham who operated under the call letters W2AG and broadcast from a tower in the yard of his house. The tower and the house are no longer standing. The Runyon living room served as a studio for a demonstration of different kinds of sound that were broadcast to a meeting of the Institute of Radio Engineers at the Engineer's Building on West 39th Street in New York City. Water was poured, paper was crumpled, and live and recorded music were beamed from the Runyon tower to the audience forty miles away.

Although the engineers marveled at the fidelity of the sound, FM did not immediately take off and it would be some time before it would become a commercial success. "If you build a better mousetrap the world doesn't necessarily beat a path to your door," Armstrong said ruefully in later years as he fought for the acceptance of his new system of broadcasting. As a matter of fact, FM was so revolutionary that an entire industry had to scrap its hardware and start over before its potential could be realized. Understandably, the establishment was less than enthusiastic at the prospect.

However, for several years RCA gave Armstrong experimental broadcast privileges in its studio at the top of the Empire State Building. But in 1937, saying that they wished to devote the space to the development of TV, they asked Armstrong to withdraw.

More determined than ever to prove the superiority of FM, Armstrong built his own station in Alpine, New Jersey. The site he chose had been visible to him as a boy from his attic cupola at 1032, and it served his purpose well. It was one of the highest

Reader Service for facing page ↙70↗

Step Up To The Cubic Communications "ASTRO 103"

Dual VFOs Give You Two Radios for the Price of One!

Competitively priced, quality American design and construction by Cubic . . . a leader for 3 decades in defense and commercial electronics

Features:

All band coverage including WWV and the new WARC bands

DUAL VFO's each provide complete band coverage. (You are not limited to a single memorized frequency)

235 Watts input, SSB and CW on all frequencies

IF Passband Tuning not to be confused with ineffective "IF shift"

Utilizes an 8 pole filter which is continuously variable for either high pass or low pass.

CW Crystal Filter (optional), 400Hz 6-pole

Unique Visual Display of Passband

External Receive Antenna Jack allows separate transmit and receive antennas

Tunable Notch Filter when combined with passband tuning, provides the ultimate in removing interference

Full or Semi CW Break-In

Selectable hard/soft keying makes the difference in pile up

Continuously Variable AGC lets you hear the weak signal which would normally be masked by strong adjacent channel interference

Logrithmic Speech Processor

AF, RF and IF Gain Controls to provide an infinite selection of receiver dynamics

4 Function Meter reads "S" units in receive, and selects forward power (calibrated in watts PEP), reflected power, or ALC level in transmit

Military Quality PC Boards of double sided, plated through glass epoxy material

Modular Construction with PC boards and assemblies interconnected by plug-in strip line and coaxial connectors. Chassis and cabinet are of rugged steel construction

Call or write for a Free Brochure

CUBIC COMMUNICATIONS
A member of the Cubic Corporation family of companies
305 Airport Road, Oceanside, CA 92054 (714) 757-7525

Complete System 103

PSU-6A
Power Supply/Speaker

ASTRO 103
Transceiver

1500Z-A
1500 Watt Linear
Amplifier

ST-2B
2kW Antenna Tuner

Interested In DX?

Dick Bash says you need **THE COMPLETE IDIOT'S GUIDE TO DX** *(by Stu Gregg, NF4Z) if:*

. . . . you think IRC means International Red Cross
. . . . you're still working on your DXCC
. . . . you think WAC means a female army person
. . . . you're not a BIG GUN (yet)
. . . . you think the 'BUREAU' is where you put your socks

The Idiot's Guide pulls no punches and doesn't 'snow' you with nonessentials, but it does unlock some DXers' secrets; for example: How to QSL, What to say, Where to place your antenna, How much power to use, Whose awards can you get, Why and When to use SSB or CW, and much more . . . things that you need to know, and information that Honor Roll members had to learn the hard way.

Dozens of DXers have been interviewed and their suggestions have been included here. Take a tip from the "Big Guns" and use their secrets and tricks.

THE COMPLETE IDIOT'S GUIDE TO DX is available at dealers nationwide for only $12.95, but if you can't stand to wait, rush Dick $15.45 (which will cover First Class postage). If you live in California, please include 84¢ for Sales Tax. *Telephone orders accepted 10 AM–6 PM California time.*

BASH EDUCATIONAL SERVICES, INC.
P.O. Box 2115
San Leandro, California 94577 ✓26
(415)352-5420

points in the region and had unobstructed space around it for the broadcast of the station's signal.

Programs originating with WQXR in New York City were transmitted by wire to Alpine and broadcast first under the call letters W2XMN and later, WE2XCC. Today, the station is owned by UA Columbia Cablevision Company of Oakland, New Jersey, and is operated for closed circuit TV transmission.

During the Second World War, Armstrong devoted himself to military research and allowed the government to use his patents royalty-free. He received the Medal of Merit for his contributions.

After the war, Armstrong turned his attention once more to the promotion of frequency modulation. He saw it grow in popularity as a broadcasting medium as more FM stations went on the air and more FM sets were sold to receive the programs. However, few outside the industry had ever heard of Edwin Howard Armstrong—the man who invented it. Furthermore, manufacturers began to build and sell FM equipment ignoring his patents. Goaded perhaps by the bitter memory of losing his regenerative patent years before, Armstrong became embroiled in twenty-one infringement actions to adjudicate his FM patents. Battling giant corporations with batteries of lawyers used up his resources. Finally, in 1954, ill, disillusioned, and his fortune gone, Armstrong took his own life.

After his death, his widow, Marion, set out to finish what he had started. She continued the lawsuits, sitting in the courtroom each day following the arguments and watching as testimony was given. Her first victory, over RCA in 1954, gave her funds to continue the other suits. In 1967, with the victory over Motorola, she had won all twenty-one and established clearly and decisively that Edwin Howard Armstrong was the inventor of frequency modulation.

Today, the Alpine tower stands as a monument to the brilliant man whose inventions touch our lives every day. His contributions are perhaps best summed up by Lawrence Lessing in his biography of Armstrong, *Man of High Fidelity* (J. B. Lippincott Company, Philadelphia and New York, 1956). "The lonely man listening to music in the night, the isolated farmer hearing nightly the news of the world, the airplane pilot guiding his craft safely through the ocean of the sky, the astronaut now in his capsule gathering in the whispers from space, the earthbound emergency crew contending with some mission of mercy or disaster, the army on the move and the man in his armchair, charmed or instructed for an hour by a great play, a symphony, a speech, a game of ball—all owe a debt to this man who, in some forty years of high fidelity, fashioned the instruments illimitably extending these powers of human communication." ■

Armstrong at his desk at W2XMN.

Barry Electronics Corp.

WE SHIP WORLDWIDE

WORLD WIDE AMATEUR RADIO SINCE 1950

Your one source for all Radio Equipment!

All Handy Talkies In Stock For Immediate Delivery!
VoCom 2 meter 5/8 Telescoping Whip & Duckie Antennas & HT Amp's HEAVILY STOCKED

TEMPO
S1, S2,
S4, S5

SANTEC
HT-1200,ST-7/T

YAESU
FT-208R
FT-290R, FT-708R

ICOM
IC2AT
IC3AT
IC4AT

We Will Not Be Undersold
Call: 212-925-7000

DRAKE TR-7 & R-7
L-7 2KW Linear Amplifier

DRAKE
Keyboard

YAESU
FT-ONE

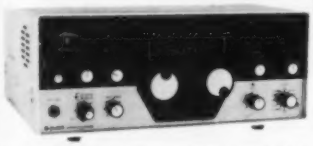
MURCH Model UT2000B

FT-101ZD MARK III, FT-480R,
FT-707, FT-720RU, FT-720RVH,
FT-902DM, YR-901-CW/RTTY

AEA Morse Matic,
MBA & IsoPole Antennas

BIRD
Wattmeters &
Elements
in stock

ROCKWELL/COLLINS
KWM-380



ASTRO 103 150A & 100 MXA
DIPLOMAT 150

ROBOT 400 & 800

World Wide Satellite Systems Available

We Stock Special Satellite Cable.
RG-213/U at $3.50 per/ft.
RG-59/U Stranded Center Core
at $0.25 per/ft.

DIGITAL
FREQUENCY
COUNTER

Trionyx-
Model TR-1000
0-600 MHz
Digimax-Model D-510 50Hz-1GHz

KDK FM-2025

MIRAGE
B1016

ICOM IC-720A, IC-730
IC-25A, IC-251A, IC-2KL, IC-451A

HY-GAIN
TOWERS
& ANTENNAS

KANTRONICS
Mini-Reader
Field Day

Super Sale On All Surplus Parts, Meters, Capacitors And Connectors, Etc...Come In And Save Over 50%

New York City's LARGEST STOCKING HAM DEALER
COMPLETE REPAIR LAB ON PREMISES

WE STOCK ARRL & BASH PUBLICATIONS.

MAIL ALL ORDERS TO BARRY ELECTRONICS CORP.,
512 BROADWAY, NEW YORK CITY, NEW YORK 10012.
BARRY INTERNATIONAL TELEX 12-7670 212-925-7000
TOP TRADES GIVEN ON YOUR USED EQUIPMENT.

AUTHORIZED DISTS. MCKAY DYMEK FOR
SHORTWAVE ANTENNAS & RECEIVERS.

"Aqui Se Habla Espanol"

WE STOCK—NEW ROBOT MODEL #800, BIRD WATTMETER, HY-GAIN, LARSEN, SHURE, KDK-2015R, TURNER, ASTATIC, VOCOM, VHF ENG., MFJ, KANTRONICS, AVANTI, CORDLESS TELEPHONES, POCKET SCANNERS, NYE, BENCHER, VIBROPLEX, ALPHA.

WE NOW STOCK COMMERCIAL COMMUNICATIONS SYSTEMS
DEALER INQUIRIES INVITED. PHONE IN YOUR ORDER & BE REIMBURSED.

305

Amateur Radio Courses Given On Our Premises

Export Orders Shipped Immediately.

TUFTS ELECTRONICS

61 Lowell Rd., Hudson, N.H. 03051

9-6 Daily (603) 883-5005 12-5 Sunday

TUFTS ELECTRONICS is pleased to introduce our two newly affiliated stores. ARLINGTON RADIO is a new store serving the greater BOSTON area. Their speciality is a new system of CONSIGNED sales with an automatic mark-down every thirty days. BUZZARDS BAY ELECTRONICS is an established electronic supplier serving CAPE COD and the PROVIDENCE area. TUFTS ELECTRONICS will be establishing a few more affiliate stores to make your shopping more convenient. For details on how to become an affiliate store contact our main office in HUDSON, NH.

ARLINGTON RADIO
1301 Massachusetts Ave
Arlington, Mass 02174
617-648-2097

BUZZARDS BAY ELECTRONICS
196 Main Street
Buzzards Bay, Mass 02532
617-759-3376

DISCOUNTS - FREE CATALOG - EXPORTS - PACKAGES

HUDSON, NH
STORE HOURS
DAILY 9-6
SUNDAY 12-5

With the completion of our recent move to HUDSON, NH TUFTS ELECTRONICS is ready to bring you more exciting innovations. Our complete AMATEUR RADIO CATALOG is again available, packed with DISCOUNTS, PACKAGE DEALS and plenty of those hard to find items! Our catalog is computerized and updated daily to assure you of the best prices and the most up to date information available anywhere. Come visit our NEW MODERN SHOWROOM. Tufts Electronics is only 30 minutes for Rte 128 in Boston via Rte 3. With the SAVINGS from our DISCOUNTS plus NO SALES TAX in New Hampshire you'll be smiling all the way! To make your shopping even more pleasant our new store hours are 9-6 daily and 12-5 on Sundays. Come visit us SOON.

DISCOUNT CATALOG

TUFTS ELECTRONICS

61 Lowell Rd.
Hudson, N.H.

FREE
WITH PURCHASE OF 3-TBA ANTENNA

ALLIANCE HD-73
HEAVY DUTY ROTOR $159.95 Value

3-TBA Tri-Band Beam
10 - 15 - 20 METER
Fixed Station Antenna

Engineering performance and Hustler's tradition of outstanding quality is yours in the model 3-TBA tri-band beam for 10, 15, 20 meters.

Improved design featuring reduced element length and unique dual resonance high Q traps reduce wind loading and overall weight, while allowing an exceptionally wide bandwidth.

Specially designed bals match for precision tuning on all three bands and static drain off. Oversized boom to element mounting and heavy duty construction throughout assures reliable operation regardless of the weather.

- Lowest SWR at resonance
- Impedance 50 ohms
- Bandwidth at no broadside 950 KHz on 10, 450 KHz on 15 and 200 KHz on 20
- 8db gain
- 25db front to back ratio
- Maximum power - legal limit
- Longest element - 23-1/2 feet
- Boom Length - 14 feet 8 inches
- Turning radius - 13 feet
- Weight - 40 lbs

$319.95

TUFTS ELECTRONICS

SAVE BOTH FOR ONLY $319.95

LIMITED SUPPLY
FREIGHT EXTRA

✓88

DISCOUNTS
EXPORTS
PACKAGES

ORDER BLANK

VISA MasterCard

OPEN DAILY 9 - 6
SUNDAYS 12 - 5

FREE CATALOG

61 LOWELL ROAD
HUDSON, NH 03051
603-883-5005

MODEL	DESCRIPTION	QUANTITY ORDERED	UNIT PRICE	TOTAL PRICE

Prices subject to change without notice

Shipping and Handling	$3.50 Min.
Amount Enclosed	

NAME _____ CALL _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

☐ Check Enclosed ☐ Visa ☐ MasterCard ☐ Send Free Catalog

Card No. _____ Card Exp. Date _____
Signature _____

✓See List of Advertisers on page 114

DX PEDITIONS INTERNATIONAL

"Making DXpeditions A Reality"

THE WEEKLY DX NEWSLETTER FOR ALL AMATEURS

52 WKS. $28 (US) N. AMERICA
$40 (US) ALL OTHERS

Name _____

Address _____

City_____ St._____ Zip_____

DXI. 999 WILDWOOD RD., WAYCROSS, GA. 31501

A TRUE STATE-OF-THE-ART COMMUNICATIONS TERMINAL!

NEW M-500 ASR

from
INFO-TECH

$1475.00
(with 12" Monitor)

$180.00
MEMORY EXPANSION BOARD (contains mailbox systems)
(10K of Memory)

For use by amateur radio operators in the transmission and reception of RTTY (ASCII & Baudot) and Morse code. Microprocessor controlled with 20K of memory (8K ROM, 8K RAM, 4K video RAM).

User programmable messages, Sel-Cal, WRU, mailbox, real time clock, large running buffers, buffers for printers, basic word processing for on-screen editing, full and half duplex, cassette tape interface, split screen formats, ASCII or Baudot printer outputs, au o-start, push to talk, accessory switches, pro i-sions for battery back-up, many other features.

The M-500 consists of three parts:
1. KEYBOARD. Connected to mainframe by 5-ft. umbilical cord for maximum operating flexibility. Entire system keyboard controlled.
2. MAIN FRAME. Houses 95% of the electronics, all I/O jacks, power supplies, modulator, demodulators. Metal frame cabinet is table top or rack mounted.
3. 12" VIDEO MONITOR. High quality to insure undistorted video, provide flexibility for operating position placement.

Order direct or from these dealers

Carlton
5640 S.W. 116th Ave.
Miami, Florida 33173
(305) 271-3675

Calmay Products
14903 Beachview Ave.
White Rock, B.C., Canada V4B1N8
(604) 536-3058

Dakta Amateur Radio Supply
212 48th St.
Rapid City, South Dakota 57701
(605) 343-6127

Electronic Equipment Bank
516 Mill St.
Vienna, Virginia 22180
(703) 938-3350

Gilfer Associates, Inc.
52 Park Ave.
Park Ridge, New Jersey 07656
(201) 391-7887

Global Communications
606 Cocoa Isles Blvd.
Cocoa Beach, Florida 32931
(305) 783-3624

Ham Radio Center
8343 Olive Blvd.
St. Louis, Missouri 63132
1-800-325-3636

Memphis Amateur Electronics
1465 Wells Station Rd.
Memphis, Tennessee 38108
1-800-238-6168

Michigan Radio
38270 Mast
Mt. Clemens, Michigan 48045
(313) 469-4656

N & G Distributing
7201 NW 12th St.
Miami, Florida 33126
(305) 592-9685, 763-8170

Radio World
Terminal Building
Oneida County Airport
Oriskany, New York 13424
(315) 736-0470
1-800-448-9338

Ray's Amateur Radio
1590 U.S. Highway 19 South
Clearwater, Florida 33516
(813) 535-1416

Universal Amateur Radio
1280 Aida Dr.
Reynoldsburg, Ohio 43068
(614) 866-4267

INFO-TECH ELECTRONIC EQUIPMENT

Manufactured by:
DIGITAL ELECTRONIC SYSTEMS, INC.
1633 Wisteria Court • Englewood, Florida 33533
813-474-9518

✓35

CALL TOLL FREE

For the best deal on

- AEA • Alliance • Ameco • ASP • Belden
- Bencher • Bird • CDE • CES • Collins
- Communications Specialists • Cubic
- Cushcraft • Daiwa • DenTron • Drake
- HAL • Hustler • Hy Gain • Icom • IRL
- KLM • Kantronics • Kenwood
- Larsen • Macrotronics • MFJ
- Mini-Products • Mirage • NPC • Nye
- Panasonic • Palomar Engineers
- Regency • Robot • Shure • Sony
- Standard • Tempo • Ten-Tec
- Transcom • Yaesu

FEBRUARY FINDS

ICOM IC-730 HF Xcvr, regular $829 ____special $729.95 (less $40 factory rebate... in effect through February!)

KENWOOD TR-2500 new 2-M hand-held in stock $299.95

HAL CT-2100 Communications Receive Terminal $759.95
KB-2100 Keyboard $157.95

YAESU FT-208R compact 2-M hand-held_____ Call!

YAESU FT-708R compact UHF hand-held_____ Call!

Quantities limited... all prices subject to change without notice

We always have an excellent assortment of fine used equipment in stock... Come in or call

CALL TOLL FREE
(outside Illinois only)

(800) 621-5802

HOURS: 9:30-5:30 Mon., Tues., Wed. & Fri.
9:30-9:00 Thursday
9:00-3:00 Saturday

ERICKSON COMMUNICATIONS
Chicago, IL 60630
5456 North Milwaukee Ave.
(312) 631-5181 (within Illinois)

AEA ADVANCED ELECTRONIC APPLICATIONS, INC.

MM-1 MorseMatic Programmable keyer. 16 button pad tailors unit to operate as a Memory Keyer, Morse Trainer, Beacon, or Automatic Serial Number Sequencer. Speed 2-99 wpm, 500 character memory. Use with all popular paddles. Keys grid block, cathode or transistor circuits. 9-16vdc @ 350 ma.

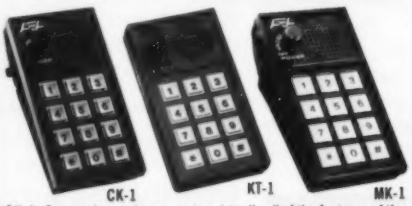
Regular $199.95 - ***Sale Price $179.95***

MT-1 Morse Trainer. Generates random Morse characters at precisely calibrated speeds, 1-99 wpm. One character speed can be selected with another (slower) actual speed. Two levels of difficulty. Select five-letter code groups, or random word length. Programmable automatic increase in speed from a beginning speed to an ending speed over a duration of .1-99.9 minutes. Normally operates in a random mode, but for checking progress, a 24,000 character answer booklet is supplied. 9-16vdc @ 200 ma.

Regular $99.95 - ***Sale Price $89.95***

MT-1P Morse Trainer. Portable version of the MT-1. Take it with you! Contains a rechargeable battery pack which provides hours of practice between charges. With battery pack and charger.

Regular $139.95 - ***Sale Price $125.95***



CK-1 Contest keyer. Incorporates virtually all of the features of the famous MorseMatic, with the exception of the Trainer and Beacon modes. Two pre-set speeds for fast recall and a stepped variable speed control for contesting. 1-99 wpm. 9-16vdc @ 350 ma.

Regular $129.95 - ***Sale Price $116.95***

KT-1 Keyer/Trainer. All of the features of the MT-1. However, except for the on/off volume control, all other functions including speed, sidetone pitch, weighting, tune & more, are programmable by using the keypad to address the internal microprocessor. Speed variable, 1-99 wpm. Automatic tune function allows two-handed xmtr tuning. Trainer provides a sequence of 24,000 characters with 10 starting positions or a random point. 9-16vdc @ 350 ma.

Regular $129.95 - ***Sale Price $116.95***

MK-1 Morse Keyer. Features similar to the keyer portion of the KT-1 without automatic tune function. 9-16vdc @ 350 ma.

Regular $79.95 - ***Sale Price $74.95***

Keyer & Trainer Accessories:

ME-1 2000 character memory expansion for MM-1..... $59.95
AC-1 12vdc/600ma. AC adaptor for MM-1 with ME-1..... 14.95
AC-2 12vdc/350ma. AC adaptor 9.95
DC-1 Cigarette lighter cord for all except MT-1P 5.95

AEA MBA-RO Basic CW/ASCII/Baudot Reader. Reads and displays up to 99 wpm CW copy, 60-67-75-100 Baudot & ASCII at 110 baud (hand typed, 300 baud). 32 character flourescent display shows up to 5 words at one time. 12vdc.

Regular Price $299.95 - ***Sale Price $269.95***

MBA-RC Deluxe Reader/Code Converter. Similar to the **MBA-RO** with the addition of a code converter which converts Morse CW input to Baudot or ASCII TTY output.

Regular Price $399.95 - ***Sale Price $359.95***

AEA PFDF Radio Direction Finder. Locates signals quickly and accurately; even those appearing for only a split-second. Self-contained computer drives electronically spun array antenna, computes relative bearing within 1° and shows it on 3 digit LED display and 16 LED ring quadrant display. Works with any FM receiver -just plug into external speaker jack; has self-contained audio amplifier & speaker. Includes 130-180 MHz VHF antenna.

Regular Price $749.90 - ***Sale Price $674.90***

AEA ISOPOLE Omnidirectional VHF Base Station Antenna. A unique, efficient twin ⅝-wavelength design using resonant decoupling sleeves. Factory tuned, low SWR over entire band - just assemble and install on 1¼" mast. Connections and impedance matching network weather protected, wind survival 80+ mph. Jr. models are shorter, ½-wavelength design. All models are UPS shippable.

ISOPOLE 144 2 meter base station antenna $39.95
ISOPOLE 144 Jr. 2 meter base station antenna 29.95
ISOPOLE 220 220 MHz base station antenna 39.95
ISOPOLE 220 Jr. 220 MHz base station antenna 29.95
ISOPOLE 450 450 MHz base station antenna (Reg. $69.95) ..... SALE 62.95

All prices and specifications subject to change without notice

MasterCard — **Call TOLL FREE & Use your Credit Card** — VISA

New AES Branch Store...
CLEARWATER, Fl - 1898 Drew St. Ph. (813) 461-4267

Store Hours: Mon, Tue, Wed & Fri 9-5:30; Thurs 9-8; Sat 9-3
(Las VEGAS & CLEARWATER stores not open Thursday evenings)

E-X-P-A-N-D-E-D WATS PHONE HOURS
Our MILWAUKEE Headquarters will answer the Nationwide WATS line **1-800-558-0411** until 8 pm (Milwaukee time), Monday thru Thursday.

Call Toll Free: 1-800-558-0411

In Wisconsin (outside Milwaukee Metro Area) 1-800-242-5195

AMATEUR ELECTRONIC SUPPLY® Inc.

4828 W. Fond du Lac Avenue; Milwaukee, WI 53216 - Phone (414) 442-4200

AES BRANCH STORES

WICKLIFFE, Ohio 44092
28940 Euclid Avenue
Phone (216) 585-7388
Ohio Wats 1-800-362-0290
Outside Ohio 1-800-321-3594

ORLANDO Florida 32803
621 Commonwealth Ave.
Phone (305) 894-3238
Fla. Wats 1-800-432-9424
Outside Fla. 1-800-327-1917

LAS VEGAS, Nevada 89106
1072 N. Rancho Drive
Phone (702) 647-3114
Pete, WA8PZA & Squeak, AD7K
Outside Nev 1-800-634-6227

ASSOCIATE STORE

ERICKSON COMMUNICATIONS
CHICAGO, Illinois 60630
5456 N. Milwaukee Avenue
Phone (312) 631-5181
Outside ILL 1-800-621-5802

Karl T. Thurber, Jr. W8FX
317 Poplar Drive
Millbrook AL 36054

The Art of Listening

—audio accessories explored

A high-quality station receiver having attributes of acceptable selectivity, sensitivity, stability, image and spurious signal rejection, and accurate readout forms the heart of any installation—amateur or SWL. Due to cost considerations, front-panel control space limitations, and other factors, not all desirable features can be included. In this article, we look at important audio-related accessories that can be used in tandem with a good set for outstanding performance and versatility. These include proper headphones and speakers, audio filters, and tape recorders. The front-panel phone jack provides the umbilical connection for these devices. The Kenwood R-1000 receiver pictured here has one interesting feature of special interest to SWLs: The function switch at upper left controls a timer used to turn on the radio for scheduled listening or to control a recorder through a remote terminal. (Photo courtesy of Trio-Kenwood Communications, Inc.)

In this interesting and highly-readable article, W8FX highlights in a casual, nontechnical way some important considerations in choosing key audio accessories for your station. Whether a licensed amateur or a serious shortwave listener, we think you will be interested in what he has to say about speakers, headphones, tape recorders, and filters for the ham shack.

No transceiver or receiver is perfect, and none comes complete with all possible accessories to fill every operating need. The design of such a radio would certainly push the technical state of the art, not to mention that it would most certainly be cost-prohibitive. Various accessories and modifications narrow the gap between needs and reality and allow one to tailor performance accordingly.

There are many receiver audio add-ons one can build or purchase: external speakers, headphones, tape recorders, audio interference filters, phone patches, radioteletype (RTTY) and Morse code readers, slow-scan television (SSTV) viewers, and monitorscopes, to name but a few performance-enhancing accessories.

In this article, we will look at construction and selection considerations for the first four groups listed above. Our review will highlight a number of commercial phone-jack products from the standpoint of their contributions to material reception improvement and making on-the-air operating a more convenient and enjoyable pastime.

Let's begin with the main link between your rig and your ears—the speaker.

Speakers: A Special Breed

Anyone who rates himself or herself a hi-fi buff knows just how important the speaker is to overall audio system performance. Unfortunately, the speaker's importance to receiver or transceiver performance is too often forgotten—by the individual ham and by manufacturers as well. Most amateur equipment made today, whether of domestic or Japanese origin, contains but an undersized, inexpensive, and inadequate loudspeaker. This results in poor audio performance from otherwise excellent equipment. Deficiencies are magnified when equipment is stacked, since the speaker is normally mounted on the top or bottom of the radio where its output will be muffled by the operating desk or other equipment above or below the radio.

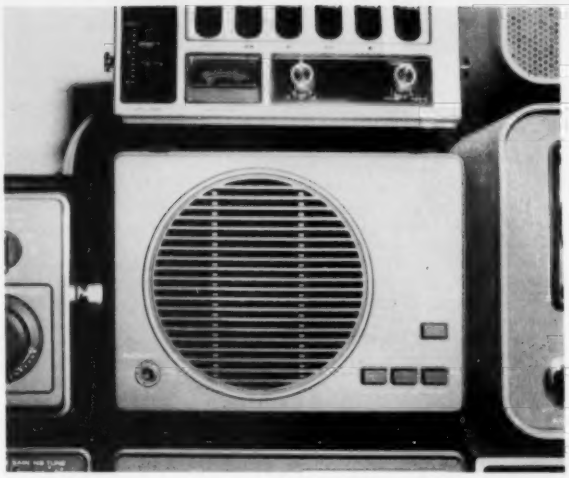
Most radios have provisions for using an external speaker, and I recommend you use one to help attain the overall performance you expect from your set.

Fixed station external speakers. It's a good idea to obtain the matching accessory speaker at the time of the receiver or transceiver's purchase. However, you should be able to use almost any communications speaker as long as the voice coil impedance matches that of your set's output, normally 8 Ohms (4-16 Ohms is the usual range).

Only a *communications*-type speaker should be used, however, as the restricted frequency response of these units is optimized for speech reproduction. Hi-fi speakers, though perhaps of superior overall quality, will unduly accentuate any low-frequency hum as well as high-frequency noise and background hiss.

Of late, I've observed that accessory speakers offered by some manufacturers are marginal in size and quality; hooking up one of these units will not produce the improvement one would expect from an external speaker. A possible remedy is to scour the next hamfest or swap meet for one of the 8- to 12-inch boat-anchor speakers of the 1950s and 1960s bearing such names as National, Hallicrafters, Collins, and Hammarlund. These units, if in good condition (voice coil intact and speaker cone undamaged), will run rings around the 4- to 5-inch jobs seen today. A little clean-up, and possibly a paint job, will do wonders to restore a unit to respectability.

You can "roll your own" versions of these increasingly difficult-to-find accessory speakers, too; your effort will likely be rewarded with superior speech quality and intelligibility. Send for the catalog of McGee Radio and Electronics, 1901 McGee St., Kansas City MO 64108. It's chock full of speaker and enclosure possibilities at moderate prices. Select a 6-inch-diameter or greater unit that will handle 5 to 10 Watts of audio power.



An external speaker is a near-must in view of the minimal speaker usually provided in most amateur gear produced today. The Kenwood SP-180 shown here is designed for use with the TS-180 series of gear; it has a few "bells and whistles" of its own. These include three selectable tone filters and two-channel selectable input. The headphone output can be routed through the tone filters, too.

For the experimentally inclined brasspounder, Skytec offers an unusual designed-for-application *CW* speaker. This acoustically tuned unit develops virtually single-signal selectivity for excellent Morse reception. The CW-1 combines an acoustic filter resonant at about 750 Hz with a loudspeaker in a small enclosure; a sleeve in the output opening may be extended

Skytec CW-1 speaker is an unusual device that is expressly designed for receiving CW radiotelegraphy. The unit combines an acoustic filter resonant at about 750 Hz with a loudspeaker to closely approximate "single-signal" selectivity. (Photo courtesy of Jim Bowles W6DLQ, Skytec)

HDP-1228

Mobile installations can benefit most of all from a carefully-chosen and properly-installed external speaker. Built-in speakers found in most HF and VHF/UHF mobile sets are inadequately sized and positioned to compete with road noise, car sounds, and passenger chatter. Inexpensive CB-type units usually work well, or a specially-designed unit such as this Heathkit® portable twin speaker can be used. Unit includes a visor mount to help direct sound downward to overcome road noise. (Photo courtesy of the Heath Company)

to vary the resonant frequency slightly.

How does it work? In the Skytec speaker, back radiation from a vertically-mounted loudspeaker near the base is deadened by sound-absorbent material. A cylindrical sound chamber (tube) is coupled to the front of the speaker through only a small hole in a plate that otherwise closes the lower end of the tube; the tube's upper end is open to the room. At the frequency at which the chamber length is acoustically one quarter wave long, it is resonant and acts as a matching section between the high impedance (to sound) of the small hole at the speaker end and the low impedance to the room of the open end. Audio energy transfer is very efficient at this frequency but it falls off sharply off-resonance.

Using this special-purpose speaker, desired signals can be peaked considerably (on the order of about 20 dB), while adjacent channel signals still can be heard in the background. This feature allows the band to be conveniently scanned without the need to switch back to the regular station speaker. The speaker can be used in conjunction with standard intermediate frequency (i-f) filters and narrow-bandpass audio-frequency (af) filters, as well. However, the filters must be compatible; that is, bandpasses must be centered on the same frequency. Thus, other filters may or may not be used to advantage with the CW-1, depending on whether their peaks may be set such that the audio pitch that results is within the speaker's response capability.

You also may want to route your radio's output to a remote location such as the workshop, patio, bedroom, or yard. A general-purpose PA type speaker (weatherproof for outdoor use) will usually fill the bill. It's advisable to allow switching between the in-shack speaker and the extension, and also for separately controlling the volume on the remote speaker. An FM wireless mike module also may be used to broadcast received signals to any standard FM receiver in the home or around the yard—more on this possibility later.

You may have noticed that many of the bells and whistles now standard on the latest transceivers and receivers are finding their way into accessories of all kinds. For example, the external speaker for my Kenwood TS-180S is not just a speaker, but a triple audio filter, audio distribution point, and headphone jack box; it can handle the outputs of two receivers, or a receiver and a transceiver. The two af filters are fixed-tuned and push-button-selectable to attenuate either low-frequency (below 400 Hz) or high-frequency (1.5 kHz or 3 kHz up) signals. The headphone output is switchable through the filters, as is the output from either audio source. A line-out jack on the rear apron provides a convenient source of filtered audio for RTTY, SSTV, monitorscope, and other applications where receiver audio is required.

The speaker's fixed filters can't compete with sophisticated "active" audio filters, but can do a good job augmenting existing i-f filtering. The narrowing of the af bandwidth to attenuate the noise component after i-f processing can materially enhance reception.

Speakers for the mobile rig. Practically all mobile amateur transceivers contain small internal speakers. The harsh sound and restricted size and range of most puts a crimp in the quality of reception of *all* signals. Although many radios have the speaker installed on the top of the rig so that the driver will hear it best, most sets aim the speaker downward—the worst possible direction. The set's full audio output is directed where it is largely absorbed by floor mats and carpeting. Even with solid-state equipment, cranking up the audio gain to overcome road noise and passenger conversation can result in microphonic-type squeals from the transceiver due to acoustic coupling back through the rig's innards.

Thus, even more so than in fixed-station operation, an external speaker is clearly desirable. Extension speakers markedly improve intelligibility when positioned and aimed better than the rig's internal speaker and will probably be more efficient than the set's speaker. This fact allows the transceiver's usual 2- to 3-Watt audio stage to be throttled back, resulting in less overall distortion—a real problem with some of the less-weighty mobile rigs, particularly handie-talkies.

A hi-fi speaker, such as that used for automobile FM/AM/tape-deck use, should not be used for the same reasons discussed previously. Instead, a 3- to 5-Watt communications-type speaker should be purchased, one designed expressly for the speech range, 300 to 3000 Hz or so. An inexpensive source of this kind of speaker is the CB market, still flooded with a mass of unsold accessories as well as two-way radios. The quality of CB-type units varies all over the spectrum, but with speakers sometimes going for $4 to $5 at discount and parts-store sales as well as hamfests and CB coffee breaks, it's not too much of a risk to try one out. Other sources of quick-and-easy mobile speakers are the small speaker boxes which are a part of many telephone amplifiers, such as the Radio

HT-Power!

SUPER STICK II
2 METER 5/8 WAVE TELESCOPIC ANTENNA

6-9DB over a Rubber Duck

$19.95

Available In BNC, TNC, Tempo S-1, Motorola and F Type Connectors

	PRICE	GAIN *	BASE CONNECTOR **	FULLY COLLAPSED
SUPER STICK II	$19.95	6-9 DB	BNC-Tempo 5/15-32 TNC-F—50239	Collapsed is a matched 1/4 Wave Antenna
BRAND C	$26.95	6-9 DB	BNC ONLY	NA Will not transmit in collapsed position.
BRAND V	$24.95	5-8 DB	BNC ONLY	NA Will not transmit in collapsed position.

* Measured Field Strength Over Rubber Duck
** Specify Base Type BNC, Tempo, Ect.

The Tuned Antenna Company brings you the Super Stick II for those long hauls with your H.T., plus our 5/8 Wave Antenna may be operated collapsed with the same operating characteristic of a Rubber Duck Antenna. The Super Stick II is available with Tempo S-1, BNC-TNC-F-PL-259 Bases at a price that is several bucks under other 5/8 Wave Antennas, making the Super Stick II the best buy around. See your local dealer for stock. Settle for nothing less than a Super Stick II.

FOR DEALER LOCATION OR TO ORDER CALL: (714) 268-0720

VISA

master charge

THE TUNED ANTENNA CO.

57

9520 Chesapeake Dr. #603
San Diego, California 92123

MFJ KEYERS
Uses Curtis 8044 IC. Iambic operation, dot-dash memories, weight control, solid state keying. RF proof.

$79.95

The MFJ-408 Deluxe Electronic Keyer sends iambic, automatic, semi-automatic, manual. Use squeeze, single lever or straight key.

Speedmeter lets you read speed to 100 WPM.

Socket for external Curtis memory, random code generator, keyboard. Optional cable, $4.95.

Iambic operation with squeeze key. Dot-dash insertion. **Semi-automatic "bug" operation** provides automatic dots and manual dashes.

Dot-dash memory, self-completing dots and dashes, jam-proof spacing, instant start. **RF proof.**

Solid-state keying: grid block, solid state xmtrs.

Front panel controls: linear speed, weight, tone, volume, function switch. 8 to 50 WPM.

Weight control adjusts dot-dash space ratio; makes your signal distinctive to penetrate QRM.

Tone control. Speaker. Ideal for classroom.

Function switch selects off, on, semi-automatic/manual, tune. Tune keys transmitter for tuning.

Uses 4 C-cells. 2.5 mm jack for power (6-9 VDC). Optional AC adapter MFJ-1305, $9.95.

Eggshell white, walnut sides. 8x2x6 inches.

MFJ-406, $69.95, like 408 less speedmeter.

$49.95

New MFJ-401 Econo Keyer II gives you a reliable, full feature economy keyer for squeeze, single lever or straight key.

Has sidetone, speaker, volume, speed, internal weight and tone controls. Sends iambic, automatic, semi-automatic, manual. Tune function. Dot-dash memories. 8-50 WPM. "On" LED. Use 9V battery, 6-9 VDC, or 110 VAC with optional AC adapter, MFJ-1305, $9.95. 4x2x3½".

Reliable solid state keying. Keys virtually all solid state or tube type transmitters.

$64.95

MFJ-405 Econo Keyer II. Same as MFJ-401 but has built-in single paddle with adjustable travel. Also jack for external paddle. 4x2x3½".

Optional: Bencher Iambic Paddle, $42.95; 110VAC adapter, MFJ-1305, $9.95. **Free catalog.**

Order from MFJ and try it. If not delighted, return within 30 days for refund (less shipping).

One year unconditional guarantee.

Order yours today. Call toll free 800-647-1800. Charge VISA, MC. Or mail check, money order. Add $4.00 each for shipping and handling.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 for technical information, order/repair status. Also call 601-323-5869 outside continental USA and in Mississippi. 47

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

See List of Advertisers on page 114

Shack 43-230 and similar units. Though small, these units seem to be adequate for casual FM-style mobile work. Old police or taxicab speakers in good condition also can be used.

For the operator who likes to occasionally use his handie-talkie in the family buggy, Heath's HDP-1228 clip-on sun visor speaker is a good bet. The 7-oz. dual speaker has two large mounting fingers (similar to those used on visor mirrors) to hold the speaker onto the visor just above the driver's head. This method of mounting allows optimum positioning of the speaker to direct the sound downward where it's needed to overcome road noise. An eight-foot-long cord and mini-plug allow easy connection to the HT or any other mobile transceiver. (This item, manufactured by Superex Electronics Corp., may have been discontinued by Heath, as I haven't seen it advertised in recent catalogs.)

Just about any CB-type external speaker will yield adequate results. However, there is one new amateur unit on the market that warrants mention: the Kenwood SP-40. This is a compact, but high-quality, lightweight (.44-lb.) speaker having a power handling capability of 3 Watts with a frequency response of 400 to 5000 Hz. Although speaker size is only 57 mm, the little unit appears to be quite efficient and free of annoying resonances and vibrations that too frequently plague lesser CB counterparts. The speaker leg has a magnet so that it easily can be mounted on any magnetic substance. If the speaker is to be installed in a location where the magnet can't be used, mounting screws or double-faced adhesive tape also can be used. Somewhat on the expensive side (about $25), the unit nevertheless represents good value (I own two, one for each automobile). The speaker's aircraft-instrument styling makes it an especially attractive complement to any mobile installation.

Headphones for the Ham Shack

Loudspeakers are great for armchair-copy SSB work and for casual, FM-style operating. But there are a number of advantages in owning and using a good set of headphones as an adjunct to the trusty station speaker.

Many DX signals are too weak and QRM-obscured to be properly copied on a loudspeaker; a good set of phones will be of considerable value in increasing your ability to pull weak and near-buried signals out of the pack, particularly on CW. Room, household, and outside distractions also will be markedly reduced, allowing maximum concentration on the signal being copied. The overall effect of using headphones can be about equivalent to doubling received signal strength, when compared with straight loudspeaker listening. This may mean the difference between a solid DX contact and none at all.

A secondary, yet important, reason for using headphones is that the phones isolate the ham shack from the rest of the household, whose members may not appreciate the objectionable whistles, squawks, and other noises that are music to the ham's ears. This is especially important when practicing code, since Morse blasting forth at 750 Hz can have a very shrill and unnerving quality that readily penetrates walls, ceilings, and floors—not to mention *people!* Apartment and condo dwellers are well aware of how unpopular Morse can be with the neighbors.

I built a small FM rebroadcaster for cord-free headphone monitoring in my ham shack. The unit shown uses the 100-mW Ramsey FM module, which easily can be tuned to a clear spot on the FM band. Output of the station's TS-180S, FRG-7, or R-1000 is fed through the Autek Research QF-1 audio filter to the FM unit. A pair of lightweight "radio headphones" completes the installation.

Communications phone requirements. Many beginners start out by appropriating the closest set of stereo hi-fi phones for their rigs, with little thought of whether the unit can do the job. Most decent stereo phones can be used, but because they are designed for high-fidelity reproduction, their wide frequency response may elevate internal receiver hum and noise to an objectionable level; also, some lead-switching needs to be done to adapt them for monaural use.

Far better, and a more suitable investment for a lifetime amateur radio career, is a good pair of *communications*-type headphones. Such phones will boast a relatively narrow frequency response, high sensitivity, and easy physical adjustment. They also will be designed for comfortable wearing over extended periods, and the earmuffs will be effective in isolating the operator from distractions. Several manufacturers sell communications-type phones, including Telex, Superex, Radio Shack, and Amplivox. Major ham gear manufacturers such as Kenwood and Yaesu offer a selection of radio headphones designed to both physically and electronically match their equipment lines.

Several considerations emerge. Input impedance should match the output impedance of the receiver or transceiver's audio stage. In almost all solid-state amateur gear this is low impedance, in the 4-to-16-Ohm range; normally, 8-Ohm headphones should be obtained, though lower-impedance units will probably work nearly as well. Some older ham gear was designed for high-impedance phones, usually 1k to 5k Ohms, however; imped-

AFFORDABLE CW KEYBOARD FROM $69.95

Transmits perfect Morse Code • Built-in 16 character buffer • Internal speaker and side-tone • Reed relay output eliminates keying problems • All solid state circuits and sockets for reliability • Speed range 5—45 WPM • Perfect companion to our MORSE-A-WORD CW code reader.

MORSE-A-KEYER KIT, model MAK-K, Complete kit of parts & manual $159.95
MORSE-A-KEYER, model MAK-F, Factory wired & tested $199.95
MORSE-A-KEYER ESSENTIAL PARTS KIT, model EPK-K. . . . . $ 69.95
(Essential parts kit for home-brewers consists of pc board, board parts and manual. You supply ASCII keyboard, cabinet, power supply & miscellaneous parts.)

Send check or money order. Use your VISA or MasterCard. Add $5.00 shipping and handling for Continental U.S. Wisconsin residents add 4% Wisconsin State Sales Tax.

Microcraft Corporation Telephone: (414) 241-8144
Post Office Box 513G, Thiensville, Wisconsin 53092
✓50

Homebrew Headquarters

— IN STOCK —

B&W coils, switches, antennas
Jackson dials and drives
J.W. Miller parts
Millen components
Multronics roller inductors
Toroids, cores, beads, baluns
Variable capacitors
Cardwell—E.F. Johnson
Hammarlund—Millen

QRP Corner

Kits

Fun Oscillator (73 2/82) 80 or 40 Meter, VFO for Fun-Mitter
40 Meter Transceiver (hr 4/80) 40 Meter, 1 watt output
IARU Transmitter (QST 12/78) 20 Meter, 6 watt output
IARU Receiver (QST 4/78) 20 Meter

PC Boards

Fun-Mitter (73 2/81) 80 or 40 Meter, 5 watt output
Fun-Celver (73 7/81) 80 or 40 Meter
Boots for the HW-8 (QST 4/79) 80-15 Meter 10-12 watt output

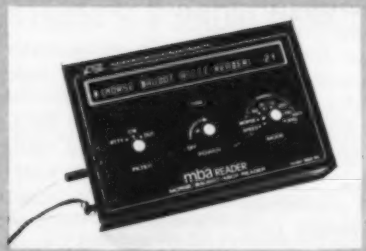
✓454

RADIOKIT
Box 411S, Greenville, NH 03048
(603) 878-1033

Catalog — 25 cents

THE LAST WORD IN READERS

THE NEW AEA MBA-RO



FEATURES:

- 32 CHARACTERS FOR EASY HIGH SPEED COPY OF MORSE
- ASCII and BAUDOT RTTY
- NO RECEIVER MODIFICATION NECESSARY
- INSTANT SPEED TRACKING FOR MORSE CODE OVER WIDE SPEED RANGE FROM 2 TO 99 WPM
- OPERATES FROM 12 V.D.C.

For AEA Readers or other AEA Products, call or visit:

AEA
Brings you the Breakthrough!

C + A ROBERTS, INC.
22010 So. Wilmington Ave.
Suite 105 Carson, CA 90745
CALL: (213) 834-5868

MFJ SWR/ WATTMETERS

MFJ HF SWR/Wattmeter reads SWR, forward, reflected power from 1.8-30 MHz.

$49.95
MFJ-814

New low cost in-line HF SWR/Wattmeter. **MFJ-814 lets you** monitor SWR, forward, reflected average power in 2 ranges from 1.8 to 30 MHz. Read 200/2000 watts forward, 20/200 watts reflected power. SWR, 1:1-6:1.

Easy push-button switch operation: has power/SWR, high/low range, forward/reflected push-button switches. SWR sensitivity control.

Lighted meter (requires 12V). Rugged aluminum eggshell white, black cabinet. 6¼x3¼x4¼". SO-239 coax connectors, 2 color meter scale.

MFJ VHF SWR/Wattmeter/ Field Strength Meters

$29.95
MFJ-812

New low cost VHF operating aids.

MFJ-812, $29.95: Read SWR from 14 to 170 MHz to monitor antenna and feedlines.

Read forward and reflected power at 2 meters (144-148 MHZ). 2 scales (30 and 300 watts).

Read relative field strength from 1 to 170 MHz. Binding post for field strength antenna.

Easy push-button operation: has forward/reflected and SWR/field strength push-buttons.

Aluminum eggshell white, black cabinet. 4¼x2¼x2¾". SO-239. 2 color meter scale.

MFJ-810, $24.95: similar to MFJ-812 less field strength function.

MFJ "Dry" 300 W and 1 KW Dummy Loads.

$64.95
MFJ-262

$26.95
MFJ-260

Air cooled, non-inductive 50 ohm resistor in perforated metal housing with SO-239 connectors. Full load for 30 seconds, de-rating curves to 5 minutes. **MFJ-260 (300 W).** SWR: 1.1:1 to 30 MHz, 1.5:1 for 30-160 MHz. 2½x2½x7". **MFJ-262 (1KW).** SWR 1.5:1-30 MHz. 3x3x13".

MFJ-10, 3 foot coax with connectors, $4.95.

Order from MFJ and try it. If not delighted, return within 30 days for refund (less shipping).
One year unconditional guarantee.
Order yours today. Call toll free 800-647-1800. Charge VISA, MC. Or mail check, money order. Add $4.00 each for shipping and handling.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 for technical information, order/repair status. Also call 601-323-5869 outside continental USA and in Mississippi. ✓47

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

✓See List of Advertisers on page 114

A good pair of headphones will last a lifetime of hamming. Though communications-type phones are usually recommended, high-quality stereo headphones are often preferred because they usually sport extra-soft, oversize cushions and padded, adjustable headbands. An adapter cord or plug would be required to convert a stereo phone such as this Radio Shack unit for monophonic use with your receiver or transceiver. (Photo courtesy of Radio Shack)

ance matching is more critical in such instances. Most military surplus headphones, often attractive because of their rugged construction and oversize earmuffs, are 500-to-600-Ohm units, though they are sometimes seen in higher- and lower-impedance versions.

Sitting in front of a ham rig for many hours at a stretch is fatiguing. Doing this while wearing an uncomfortable set of headphones, sporting a tight and close-fitting headband, is torturous. For reasons of retaining one's sanity and a pleasant disposition, it's critically important to purchase earphones having good earmuffs; the muffs keep the signal in and distractions out. Thick, but soft, flexible pads are what are required; they should be held fairly tightly against the head by the headband's pressure, though not so tightly as to be noticeably uncomfortable. One should be careful in purchasing used headphones, even if they're OK electrically, because old earmuffs eventually become shopworn and stiff, primarily due to their having been soaked in the operator's perspiration. Deterioration of the high-frequency response is the result, along with a reduced isolation ability. Overly large, heavy headphones should be avoided due to the discomfort caused by carrying their weight over an extended period.

Some features to look for include a coiled cord, individual headset volume controls, interchangeable or easily-replaceable earmuffs, type of headband construction (single, double, padded, etc.), and a means of adjusting the headband. These factors may be either pluses or minuses, depending on individual operator preferences.

I have found that buying headphones is one task that is best done in person, not by mail. It's important to try out the phones, if possible with the radio with which they will be used, both from the standpoint of equipment compatibility and operator comfort. All the printed specs in the world are useless if you can't comfortably wear the phones over a long timespan. If possible, borrow several different phones from friends and check out their suitability in your own station before making your choice.

Except for mobile work, where a *single* headphone may be worn in conjunction with a boom mike/headset combo, a *pair* of headphones is universally used. Since the human hearing system tends to cancel out noise which is applied equally to both ears, adding the second headset allows recognition of signals several dB lower in level than with a single headset. Also, most people do not have equal or symmetrically balanced hearing in both ears; dual phones tend to minimize this anomaly.

A few headphone operating tips should prove helpful:

1) Try using a pair of fitted earplugs under the headphones. Desired signals will come through the earplugs fairly well, while noise will be suppressed. Using earplugs is particularly effective when working on an extremely noisy band for a long stretch. You also may find fatigue is reduced.

2) Experiment with reversing the audio leads to one headphone. The human ear tries to cancel out noise which is presented in-phase to both ears; swapping the normally in-phase headsets can produce a substantial readability improvement while letting the signal of interest through with minimum impediment. If results are favorable, you may wish to install a switch to conveniently reverse phase for routine listening.

3) Learn to "ride gain" on your set's rf and af gain controls, avoiding "blasting," which will have the temporary but undesirable effect of desensitizing the ears. Generally, best CW copy is had by running with the af gain wide open (or nearly so) and working with the rf gain control, keeping levels low enough to avoid receiver and headset overloading. A good receiver agc system makes doing this a lot easier.

4) When operating on CW, carefully adjust the set's main tuning or beat frequency oscillator (bfo, if the set has one) to produce a strong yet pleasant audio tone. Don't opt for a too-low pitch; around 750 Hz is usually about right, give or take 100 Hz, or so.

5) If you're an inveterate SSB contester, consider the use of a boom mike/headset combo. This device replaces, or supplements, the transceiver's existing mike and speaker. The boom is attached to the back of one of the headphones and curves around the operator's cheek, thereby positioning the mike directly in front of the mouth for close-talking and essentially hands-free operating. A press-to-talk (PTT) switch is part of the cord itself, though most boom-mike assemblies can be "hot-wired" and a foot-switch used for PTT switching for true hands-off operation. Use a double-headset type for fixed-station operation and ensure that mike and headphone impedances are right for the transceiver or receiver/transmitter pair with which the combo is to be used. Avoid cheap CB-type boom assemblies like the plague!

6) If you want to try cord-free headphone operation, purchase a pair of lightweight, cordless FM radio headphones—the kind that has a built-in FM or AM/FM radio inside the headphone

RTTY/CW For the TRS-80*

* A Trademark of the Tandy Corp.

ROM-116
RTTY/CW Operating System

Detailed brochure available on request.

Featuring:

1200 BAUD OPERATION. Not limited to 110 baud because of timing loops. 60, 66, 75 & 100 W.P.M. Plus 110, 150, 300, 600 & 1200 baud operations possible.

FLEXABILITY OF OPERATION. Instantly change: Baud Rates; Program Mode (ASCII/baudot); Program Status.

SPLIT SCREEN VIDEO. Transmit & receive data displayed separately.

REAL TIME. Automatic CW/ID without user intervention. Automatically updates at end of month or year.

Other features include:

- Two Serial Ports
- Fourteen Buffers
- Automatic CW ID
- Transmit Control
- Selective Call Feature
- Error Correction
- Word Wrapping
- Easy To Interface
- 30 Day Unconditional Guarantee
- Hardware requirements: TRS-80 Model 1 or 3 16K External terminal unit.

CROWN MicroProducts

606 State Street, P.O. Box 892-R • Marysville, WA 98270 • (206) 659-4279

Also Available . . . .
Floor Space: 51" Wide by 30" Deep
$192.50

. . . at last . . . your shack organized!

A beautiful piece of furniture — your XYL will love it!

$164.50 S-F RADIO DESK

Deluxe - Ready to Assemble

Designed with **angled** rear shelf for your viewing comfort and ease of operation.

FINISHES: Walnut or Teak Stain.

Floor Space: 39" Wide by 30" Deep

Additional Information on Request.

Checks, Money Orders, BankAmericard and Master Charge Accepted.

F.O.B. Culver City. (In Calif. Add 6% Sales Tax.)

DEALER INQUIRIES INVITED

S-F Amateur Radio Services

4384 KEYSTONE AVENUE • CULVER CITY, CALIF. 90230 — PHONE (213) 837-4870

✓65

OVER 70 BRANDS IN STOCK
DRAKE
BIRD
LAND-MOBILE RADIO
HYGAIN • ARRL
AMATEUR RADIO
ICOM
SHORTWAVE
SCANNERS
TEN-TEC
B&W • CDE
BEARCAT • MORGAIN • MANY MORE...

Full Service Shop • Spectrum Analysis • Antennas
New and Used Equipment • CW-SSB-FM, Etc. • Towers
FCC Study Guides • Code Tapes • Books • Accessories

SPECTRONICS

Specialists in Amateur Radio, Short-Wave Listening And Contemporary Electronic Gear.

HOURS
MON, TUES, WED.: 9:30-6:00 PM
THURS, FRI.: 9:30-8:00 PM
SAT.: 9:30-3:00 PM
CLOSED SUNDAYS, HOLIDAYS

SPECTRONICS, INC.
1009 GARFIELD ST. OAK PARK, IL 60304
(312) 848-6777

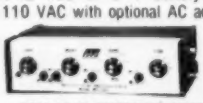
MFJ SHORTWAVE ACCESSORIES

NEW Indoor Tuned Active Antenna. Rivals, can even exceed reception of outside long wire.

Rivals long wires

$79.95

MFJ-1020 NEW INDOOR ACTIVE ANTENNA sits on your desk ready to listen to the world. Rivals, can often exceed, reception of outside long wire. Unique **Tuned** Active Antenna minimizes intermod, provides RF selectivity, reduces noise outside tuned band. Also use as preselector for external antenna. Covers 300 KHz to 30 MHz in five bands. Adjustable telescoping antenna. Controls: Tune, Band Selector, Gain, On-Off/Bypass. LED. FET, bipolar circuitry. Phono jack for external ant. 6x2x6 inches. 9-12 VDC or 9 V battery for portable use. 110 VAC with optional AC adapter, $9.95.



$99.95

MFJ-1040 RECEIVER PRESELECTOR. Improves weak signal reception, rejects out-of-band signals, reduces image response, 1.8 to 54 MHz. Up to 20 db gain. Low noise MOSFET. Gain control. Bandswitch. Can use 2 ant., 2 rcvrs. ON-OFF/Bypass. 20 db attenuator. LED. Coax, phono jacks. 8x2x6 in. Also for XCVRS to 350 watts input. Auto bypass. Delay control. PTT jack. **MFJ-1045, $69.95.** Same as MFJ-1040, less attenuator, xcvr auto bypass, delay control, PTT. Use 1 ant., 1 rcvr. 5x2x6 in. 9V bat. Both requires 9-18 VDC or 110 VAC with optional AC adapter, $9.95.

$89.95

MOBILE SWL CONVERTERS to hear the shortwave world while you drive. **MFJ-304** ($69.95) covers 19, 25, 31, 49 meter bands. **MFJ-308** ($89.95) adds 13, 16, 41, 60 meters. Two dual-gate MOSFETS give excellent sensitivity, selectivity with car receiver. Push button band selector. Tune with car radio. Plugs between antenna and radio. 12 VDC. **304** is 5¼x1¼x4". **308** is 6¼x1¼x5". **Free catalog.**

MFJ-10, 3 foot coax with connectors, $4.95.

Order from MFJ and try it. If not delighted, return within 30 days for refund (less shipping).
One year unconditional guarantee.
Order yours today. Call toll free 800-647-1800. Charge VISA, MC. Or mail check, money order. Add $4.00 each for shipping and handling.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 for technical information, order/repair status. Also call 601-323-5869 outside continental USA and in Mississippi. ✓47

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

✓See List of Advertisers on page 114

itself—and feed your rig's output to a small wireless FM broadcaster module. Doing this allows true cord-free flexibility in the ham shack by doing away with clumsy, entangling headphone cords. The setup also has the benefit of allowing one to monitor band or net activity anyplace in the home or yard by tuning in the rebroadcaster on any standard FM receiver. Ramsey Electronics, 2575 Baird Rd., Penfield NY 14526, sells a simple, 300-foot-range kit for $3.95. Food for thought!

Using stereo phones. We have cautioned against using stereo hi-fi headphones in the ham shack, regardless of their quality and comfortability. Headphones with extremely wide frequency response characteristics simply reproduce additional interference, detracting from desired signals. Nevertheless, many hams will wish to use a pair of existing stereo phones for reasons of economy or personal preference. Hands-on experimentation will reveal if the pair will, in fact, be suitable for use.

Unfortunately, you can't just plug a set of stereo phones into your ham rig. Almost all such headphones use a so-called standard three-conductor (including ground) plug, one circuit being used for each channel. Most amateur equipment uses a two-circuit (including ground) jack for use with *monaural* communications headphones. This fact requires replacement of the headphone's 3-circuit plug with a single-circuit plug and the paralleling of the two separate leads so that the receiver's output will be fed to both headset units. Alternately, the stereo headphone's plug can be left intact and an adapter purchased or fabricated to convert the stereo-configured cord to monaural use. Using an adapter has the advantage of allowing the headset to be used as a stereo unit whenever desired, without making further wiring changes.

If you *do* purchase a set of stereo headphones to use with your ham rig, consider a suitable pair that has an internal "stereo-mono" switch. This feature alleviates the need for an adapter plug. I own a Calrad 15-135 headset that does a creditable job both in the ham shack and with a small stereo set, and it boasts individual earphone volume controls, a coiled cord, and comfortable muffs.

I've indicated that the stereo headphones' wide frequency response may be annoying when used with ham gear. This may be particularly aggravating if you try to use a pair of stereo phones in tandem with an active audio filter, since the filter may emphasize residual ac hum and noise present in the receiver or transceiver's audio output. You can minimize this problem by adding a 50- to 150-Ohm, 1/2-Watt resistor in series with the headphone lead to cut down their low-frequency response and overall sensitivity. The exact value to use must be determined by experiment.

Tape Recorders

Though by no means necessary accessories, tape recorders represent often overlooked but very useful station adjuncts. There are countless practical uses for recorders, many of which are suitable for the ham shack. In fact, many amateurs wouldn't be without one any more than they would be sans mike or key.

Ham shack applications. Small recorders have a wide range of applications in the ham shack that is limited primarily by the individual operator's ingenuity and imagination. Recorders can be used for such diverse purposes as recording DX and other important contacts, verifying transmitted audio quality, recording messages and traffic, code practice, making short CQ and other transmission tapes, signal reporting, and SSTV signal origination, to name but a few popular uses. Let's look at some of these:

Using a high-quality pair of communications-type headphones has several advantages. Switching from speaker to headphones can materially improve the readability of received signals and keep distracting room noise out. Lightweight units with soft cushions that are peaked for communications-range audio are best. Low-impedance models, such as the Yaesu headset shown here, are suitable for most modern solid-state receivers and transceivers. (Photo courtesy of Yaesu Electronics Corporation)

1) *Taping contacts.* This represents the most common, obvious use of the recorder. The machine is simply connected to the receiver's output jack, either through a Y-plug across the speaker or, in some sets, to an auxiliary tape-output jack. The tapes made can serve as documentation for exceptionally rare QSOs and as a logging aid in fast-paced DXing and contest work. (In the latter application, a reference time is recorded at the beginning of the tape so that log entry times can be conveniently determined.)

2) *Signal reporting.* Another common use is to provide "live" signal reporting to others. Most hams are genuinely surprised to learn how they really sound over the air, particularly at a far-distant location. They are usually highly appreciative of an offer to play back their signal to them as much more meaningful than a simple readability-and-strength report. If you make a practice of providing on-the-air playback, keep the engineering practice up to snuff: hardwire the connections (no mikes placed up against the set's speaker), and ensure that your wiring arrangements permit professional switching between mike and recorder. Random bleeps and fast-forward monkeychatter are not well received over the air. A recorder with an accurate tape counter is a near-must.

3) *Transmitted signal quality checking.* A good

PORTA-PEATER™ INSTANT REPEATER

Command and control module makes an instant repeater from any 2 radios with absolutely no modifications to the radios. Interfaces via the external speaker and mic jacks. Perfect for a personal, emergency, or fixed repeater. Write or call for detailed data manual. We accept VISA and M/C. Request catalog.

- 4 individual CW-IDs (1K PROM)
- VOX—COR, COR triggers
- Adj. 0–15 min. ID cycle timer
- Adj. 0–15 min. Time Out timer
- Adj. 0–30 sec. hang timer
- Adj. 20db local mic amp
- True repeater beacon, or manual modes
- 250 volt switching capability
- Complete gain/interface controls
- Complete technical manual
- PCB size 5¾" x 5¾"
- 22 pin edgecard interface

$99.00 **Assembled, Tested, Burned In, Programmed (Inc. $3. postage)**

302

W-S ENGINEERING
P.O. BOX 58
PINE HILL, N.J. 08021
24 HR. PHONE: 201-852-0269

MFJ Hybrid Phone Patch

Feature Packed: VU meter. Has receiver gain, transmitter gain, null controls. Bypass switch. RFI filtered. VOX or push-to-talk. Works with any rig.

Crisp, clear hum-free audio is what phone patching is all about and MFJ has it.

$64.95

"MFJ-624 TELEPATCH II" — the hybrid phone patch with the most wanted features.

Gives you crisp clear, hum-free audio which is what phone patching is all about. Use automatic VOX or manual push-to-talk.

VU meter monitors telephone line levels. Lets you adjust null control for maximum isolation between receiver and transmitter.

Separate transmitter and receiver gain controls eliminate readjusting rig's controls.

Function switch: OFF for normal operation. ON connects rig to phone line for patching. NULL switches VU meter to adjust for null.

Simple 2 cable installation (plus phone line) when rig has patch-in-patch-out jacks. Connects easily to any rig. RFI filters, PC board construction eliminate RF feedback.

Phono jacks for patch-in-patch-out, speaker, microphone. Screw terminals for phone lines.

Eggshell white, walnut sides, 8x2x6 inches. **MFJ-620, $54.95.** Same as MFJ-624, less VU meter, 6x2x6 inches.

Order from MFJ and try it — no obligation. If not delighted, return it within 30 days for refund (less shipping). One year unconditional guarantee.

Order today. Call toll free 800-647-1800. Charge VISA, MC or mail check, money order for $64.95 for MFJ-624 or $54.95 for MFJ-620 plus $4.00 each shipping and handling.

Enjoy quality phone patching, order now.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 for technical information, order/repair status. Also call 601-323-5869 outside continental USA and in Mississippi.

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

47

MIRAGE MIRAGE MIRAGE
COMMUNICATIONS EQUIPMENT, INC.

5 YEAR WARRANTY
Parts and Labor
1 yr. on RF Power Transistors

Peak Reading Watt/SWR Meters

MP1 — HF
1.8 to 30 mhz
25, 200, 2000 watts ± 5%
$119.95

MP2 — VHF
50 to 200 mhz
50, 500, 1500 watts ± 5%
$119.95

2 Meter "All Mode" Amplifiers
FM - SSB - CW

B108	10 W. in — 80 W. out	$179.95
B1016	10 W. in — 160 W. out	279.95
B3016	30 W. in — 160 W. out	239.95
B23	2 W. in — 30 W. out	89.95

These amplifiers, except B23, have built in RX preamps. The B108 and B1016 may be used with HTs or transceivers. They will key with 1 Watt input.

New!! D1010 430-450 Amplifier
"ALL MODE" FM-SSB-CW-ATV

10 W. in — 100+ W. out
2 W. in — 25+ W. out
$319.95

RC - 1 Remote Control **$24.95**

SEE YOUR NEAREST DEALER FOR INFORMATION

MIRAGE COMM. EQUIP., INC. · P.O. BOX 1393 · GILROY, CA 95020 · (408) 847-1857

BASSETT HELIUM MOBILE ANTENNAS

For Commercial, Amateur, and Government Services

Rugged, low drag, high efficiency mobile antennas engineered to maintain resonance at all times.

Maximum overall height of only 70". Average weight of only 6 oz. They remain vertical at all speeds.

Helical inductors sealed in helium filled Fiberglass impervious to all weather. Adjustable 17-7ph whips and solid brass hardware chrome plated and polished.

Optimum gain collinears for VHF and UHF. Unity gain models for HF. Amateur band models are inventoried for "off the shelf" delivery. Commercials to specs.

Write or phone for free brochure and prices on Bassett mobiles and Helium Trap Antenna Systems.

REX BASSETT ELECTRONICS, INC.
1633 NE 14th Ave., Bldg. 11
Ft. Lauderdale, Fla. 33305
Tel: 305/561-1400

440

See List of Advertisers on page 114

The uses for a tape recorder in the ham shack are legion: taping QSOs, CQs, code practice, traffic for relay, etc. The recorder is probably of most use to the SSTV enthusiast in editing programs and recording QSOs—though recorders for SSTV work must be a cut above the average home-type cassette. The Sony C-104, shown above, is ideal for these purposes.

way to find out how *your own* signals sound is by using your recorder to tape them. You will need an auxiliary receiver for the purpose, one whose antenna can be disconnected or which has an attenuator to eliminate front-end overload by your own signal. You can record your actual on-the-air transmissions and QSOs, of course, but if you do any extensive "hello . . . testing" for the specific purpose of making a tape check, be sure to use a *dummy load* rather than radiating a signal.

4) *Code practice.* You easily can make custom code-practice tapes using your key, keyer, audio oscillator, and/or keying monitor in your transceiver or transmitter to feed the recorder's input. If you have an open-reel machine, you can in most cases vary the recorder's speed in a 2:1 ratio, that is from 1-7/8 to 3-3/4 ips, or from 3-3/4 to 7 ips. This capability allows code tapes recorded for the level of instruction desired (audio pitch will change, naturally). The recorder also can be used to tape on-the-air code practice sessions regularly broadcast by W1AW, the ARRL station at Newington, Connecticut, for later playback and practice.

5) *Traffic handling.* Using a recorder as a running backup in traffic handling is a good idea practiced by many experienced brass-pounders. If you handle a great deal of traffic, you know that a telephone call or other unwanted interruption can make you miss part of a message or cause you to hold up your net while you get a "fill." Using the recorder, you can effectively tape your own fills.

6) *Taping CQs and other transmissions.* There is nothing wrong with prerecording phone CQs, if the practice isn't overdone and technical quality is maintained. For the most part, tape-recorded CQs are not necessary, and those using them often sound a bit silly. However, for contesting and some DX work, there *are* time-saving possibilities. A related application lies in making extended antenna adjustments and TVI checking. Since radiating an unmodulated carrier is illegal (except for short periods), you may want to prerecord a signal which can be played through your transmitter again and again. For both these applications, special continuous-loop tapes are available; these come in various lengths to fit the desired transmission message length. Again, the watchword is moderation—don't overdo a good thing!

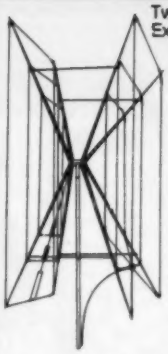
7) *SSTV recording and playback.* The tape recorder is a "must" for the SSTVer, who finds a wide range of specialized applications. These include generation of gray scale, test pattern, and other reference signals; immediate playback of the other fellow's over-the-air picture; and building a library of interesting programs from two-way contacts. By far the most important use is in prerecording one's own "programs" for later broadcast. This allows for careful preparation and capturing of artwork and photography, tape editing, and review. The judicious use of a simple tape machine has enabled many SSTVers to produce very smooth, interesting and professional-quality program material that's a pleasure to watch.

8) *Computer interface.* Small cassette recorders provide the basic means of programming home-type microcomputers. If you're equipped with a microcomputer with an electronic RTTY and/or CW interface, the recorder provides the means to set up the computer for RTTY or Morse transmission and reception, and it also serves other ancillary functions. For example, in the author's Macrotronics M-650/PET 2001 system, the recorder is used to prerecord messages for later transmission and to record received messages. So-called "brag tapes" and artwork can be stored on the tapes and exchanged with others.

Besides these specific uses, it's often handy to use a tape recorder to verbally document equipment settings and alterations, meter readings, and test results. The work being done is described as *you're doing it,* with the recorder doing the "writing." Subsequent playback of the tape, and written transcription to a notebook or log if required, may be helpful in interpreting and analyzing results and in learning from past mistakes.

Technical considerations. Authentic high-fidelity sound reproduction isn't a necessity in a ham shack recorder, though a few requirements *do* exist. The recorder should be of reasonably good quality (not a child's toy, to be sure), feature low distortion, have an auxiliary input for direct connection to the receiver's speaker, and include a recording level meter and tape counter. A "pause" or "edit" control is also a desirable feature. Requirements are tighter if the unit is going to be used to record SSTV signals or interface with a microcom-

GEM-QUAD FIBRE-GLASS ANTENNA FOR 10, 15, and 20 METERS



Two Elements $215.00
Extra Elements $154.00

Price is F.O.B. Transcona

INCLUDES U.S. Customs Duty

KIT COMPLETE WITH

- **SPIDER**
- **ARMS**
- **WIRE**
- **BALUN KIT**
- **BOOM WHERE NEEDED**

2 element 2-meter Quad N/C on request, introductory offer with purchase of quad.

WINNER OF MANITOBA DESIGN INSTITUTE AWARD OF EXCELLENCE

Buy two elements now — a third and fourth may be added later with little effort.

Get a maximum structural strength with low weight, using our "Tridetic" arms.

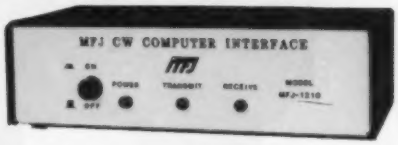
GEM QUAD PRODUCTS

Transcona, Manitoba, Canada R2C 2Z5
Box 53 Telephone (204) 866-3338

TRS-80* I, III OWNERS:

Send and receive CW with MFJ's new CW transceive program and interface. Just plug-in interface, load program and operate. Gives you Tri-Split screen, 3295 character buffer, 10 memories, "Fist Fixer."

All you need to send and receive CW.



$99.95

*TRS-80 is a registered trade mark of Tandy Corporation.

TRS-80 Models I and III CW Transceive program and interface lets you send and receive CW. No modifications to rig or computer.

Tri-Split screen for receive, transmit, message index. On screen transmit/receive "LEDs", transmit speed indicator, "Fist Fixer."

TRANSMIT: 3295 character (or more) buffer. Preload buffer while receiving. Transmit when ready. Ten 199 character memories. Repeat/link memories. Erase character, buffer, screen. 12-55 WPM. Store 2200 characters for group practice.

RECEIVE: Adjustable "Fist Fixer" helps to copy poorly sent CW. Self-adjusting to 100 WPM. Returns to receive when transmit buffer is empty. Store up to 5 screens of received CW.

HARDWARE INTERFACE: Plugs between rig and computer. Noise limiter, 4 pole active bandpass filter, post detection filter, tracking comparator. Keys tube or solid state rigs. Tuning, transmit, ON LEDs. 6x1¾x3 inches. Aluminum cabinet. RF shielded. 9-18 VDC or 110 VAC with optional MFJ-1312 AC adapter, $9.95.

Requires TRS-80 Model I or III with at least 16K. Program supplied on cassette tape.

Order from MFJ — no obligation. If not delighted, return within 30 days for refund (less shipping). One year unconditional hardware guarantee.

Order today. Call toll free 800-647-1800. Charge VISA, MC or mail check, money order for $99.95 plus $4.00 shipping and handling. Order MFJ-1210 for TRS-80 Model I or MFJ-1212 for Model III.

Enjoy CW. See dealer or call MFJ today.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 for technical information, order/repair status. Also call 601-323-5869 outside continental USA and in Mississippi. ↵47

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

NEW for your TRS-80*
Code Class

LEARN
MORSE CODE

Code Class is a machine language program designed to teach the beginning Ham to copy and send Morse code. It is very simple to use and exceptionally effective. With Code Class you will be ready for your FCC license exam in no time. Each of the lessons contains only 4 characters and may be repeated as often as you wish. Lessons combine both easy and hard characters so you learn the whole alphabet. Also, for a greater challenge, the characters learned in previous lessons may be included in the current lesson. Of course, the speed may be changed at any time without interrupting the lesson.

PRACTICE
FOR LICENSE UPGRADE

The code practice portion of Code Class is designed to help you increase your speed and accuracy as simply as possible. You will be able to practice copying random words, random characters or random callsigns. After each page of text the program stops to let you check your accuracy. You may then try the same page again or a new page. The speed is always displayed and is adjustable at any time, even in the middle of a page. And changing the speed does not interrupt the character flow.

RECEIVE
HANDSENT CODE

Code Class helps you learn to send clean, correct Morse Code. When coupled with a Macrotronics Ham interface listed below, Code Class will copy your handsent code. Warning, this might hurt your ego, but it will quickly improve your fist. Code Class even displays your sending speed.
Requires a TRS-80 Model I (16K, level II BASIC) or Model III (16K, level III BASIC). To receive handsent code attach a Morse key and any Macrotronics Ham interface (M80, M83, CM80, CM83, TM80, TM83 or Terminall). Add any audio amplifier for super sound effects. Disk $39, Cassette $29. Specify Model I or III.

TO ORDER TOLL FREE
1-800-344-7493
In CA & for service (209) 634-8888/667-2888
* TRS-80 is a recognized Trademark of Tandy Corporation

MACROTRONICS, inc.®
1125 N. Golden State Blvd.
Turlock, California 95380 ↵44

↵See List of Advertisers on page 114

puter; in these cases, a top-quality recorder having low wow and flutter should be selected. Other desirable, though not absolutely essential, features include a monitoring and/or auxiliary speaker jack, public address (PA) mode, automatic shutoff or track reverse, and fast forward and reverse capability. A monophonic unit is fine; there is little advantage in using a stereo unit.

Several tape formats are suitable: eight-track, reel-to-reel, and cassette. The eight-track recorder, operating at 3-3/4 ips, uses 1/4-inch tape in a track configuration that allows eight mono channels or four stereo channels to be recorded. Since the cartridge is actually an endless tape loop, it will run continuously if left to play out. Very short length cartridges are available, making this format excellent for phone CQs and even short SSTV "takes." The eight-track format does have its drawbacks, however, in terms of less-than-optimum audio quality, a tendency for tapes to become jammed internally, and the objectionable "click" and momentary loss of audio when tracks are switched.

The open-reel recorder is hard to beat for quality. Its distortion figures and frequency response are best among the three formats. Various combinations of reel size, tape length, speed, and available accessories add up to maximum versatility and flexibility. Recorder mechanical design is relatively straightforward (when compared with eight-track and cassette models), and maintenance is less difficult and costly to perform. However, the open-reel recorder—at least a good one—is expensive, and tapes are not as convenient to use as in the other two formats, manual tape threading being required on most models.

Tape recorders find many useful applications in the ham shack. A growing use is connection with digital microcomputers, where they are used for loading and recording of cassette programs and data. Radioteletype (RTTY) and Morse code interfaces are available from several sources for popular home computers such as the Apple, PET, and TRS-80, shown here. In addition to the basic program-loading function, the recorder can be used to digitally record on-the-air transmissions and to prerecord outgoing messages (including "brag tapes") for later broadcast. (Photo courtesy of Radio Shack)

The cassette machine is the most popular for ham shack use today, for reasons of relatively low cost, operating convenience, and steadily increasing quality. The cost of a small cassette unit is certainly not prohibitive, with usable machines available for as little as $25 to $30. Even high-quality monophonic portables come in at less than $100. The ever-increasing popularity of cassette machines is due in large measure to the ease with which tapes can be selected, loaded, recorded, and removed from the recorder, features that are very attractive for station use. Tapes in practically any length can be obtained for recording periods up to 120 minutes or more, using the standard cassette speed of 1-7/8 ips. The biggest disadvantages are that cassette editing isn't practical, the low tape speed mitigates against top quality recording, and accurate cueing is difficult. Most portable machines have an audio response that is entirely adequate for ham-band and shortwave signal reproduction, however.

An SSTVer, I opted for the Superscope C-104, a very high quality mono portable that includes such desirable features as cueing capability, pause control, nicad operation, built-in condenser mike, PA function, and variable tape speed. The front-panel controls and meter make it especially convenient for stacking above the station speaker or receiver—you don't have to look down on the recorder to operate it, as one must do with most small portables.

Standard front-loading stereo decks offer excellent potential though probably represent an overkill in quality. A stereo deck or recorder obtained at a reasonable price could likely be put to good use in the shack, though the second channel would be wasted. The micro-cassette recorders also offer good possibilities. Many of these units are quite small, can be operated vertically, and thus can be sandwiched in between equipment units on the operating console.

In using a recorder in your station, you may experience trouble with rf pickup, making it unusable when transmitting. The problem can be acute in solid-state units and comes about because of audio rectification of your signal by the set's amplifier stages.

Alaska Microwave Labs

4335 EAST FIFTH STREET ANCHORAGE
ALASKA 99504 (907) 338-0340 DEPT 73

GaAs FETs
MGF 1400 $19.00
MGF 1412 $64.00
MGF 1200 $14.00
MGF1

TRANSISTORS
MRF 901 $3.00
MRF 911 $4.00
BFR 90 $3.00
BFR 91 $3.50
MEC 07857 $3.75
MEC 07835 $5.00
MEC 97835 $14.00

CAPACITORS

IC's
MMA-110 $8.75
MMA-120 $8.70
MMA-130 $9.80
MMA-320 $10.00
NEC MC 5471 $13.30
NE 5541 FUL $7.65
NE 5512 $1.75
MC 1356 (DA XMTR) 2.50

COAX CONNECTORS
BNC PLUG $ 1.95
BNC PLUG RG-58 1.95
SMA CRIMP RG58 6.40
SMA CRIMP 8.50
SMA PLUG 6.75
SMA PLUG 6.75
SMA PLUG 3.98
TYPE 'N' 3.75
TYPE 'N' PLUG 3.75
TYPE 'N' 7.25

DUAL GATE MOSFET
RCA 40673 $4.00

FERRITE ISOLATORS
SILVER PLATING
NEW!

RF CABLE

MIXERS
.5/1 - 4.2 GHz $200.00
.9 - 1.3 GHz $85.00

HOT CARRIER DIODES
MSD 101 $4.50
MD 4831 $21.00
MM-1 +2.00

VTO's
VTO-70 $98.00
VTO-72 $98.00
NEW!

PISTON TRIMMERS
MMBO (.100-.014) $7.50

OPEN AT 8PM EST. CLOSED 8PM PST
ORDERS ARE POSTAGE PAID
COD-VISA-MASTERCHARGE
IF YOU DO NOT SEE WHAT YOU WANT ASK
406

NEW VIDEO TAPING AIDS

VIDEO STABILIZER: **Eliminates copyguard. Lets you duplicate and play any pre-recorded tape.** ***DISTRIBUTION AMPLIFIER/SWITCHER:*** **Lets you tape 4 copies at one time and select from 4 video and audio sources.**

VIDEO STABILIZER MFJ-1400 **$79.95**

DISTRIBUTION AMPLIFIER/ SWITCHER, MFJ-1410 **$99.95**

VIDEO STABILIZER, MFJ-1400. Copyguarded tapes cause picture roll and jitter that prevents viewing and duplicating prerecorded tapes. The MFJ Video Stabilizer removes copyguard so you can play copyguarded tapes on any TV set and duplicate any prerecorded tapes. Simply adjust Lock Control for stable picture. 4x2x6 inches.

VIDEO-AUDIO DISTRIBUTION AMPLIFIER/SWITCHER, MFJ-1410. Lets you tape 4 copies at one time that are as good as the original. Amplifiers supply video and audio power boost that eliminates generation loss and signal degradation. **Built-in video-audio switcher** lets you select from four video-audio sources (VCR's, games, etc.) and distribute to 4 outputs (VCR's, monitors, etc.) without touching a single cable. 6x2x6 inches.

Both units have standard RCA jacks, eggshell white cabinet with simulated walnut grain sides. 110 VAC or 12 VDC for portable use.

Premium video coax cables with RCA plugs. Gives distortionless video signal transfer, 5 feet. $24.95 per pair.

Order from MFJ and try it — no obligation. If not delighted, return it within 30 days for refund (less shipping). One year unconditional guarantee.

Order today. Call toll free 800-647-1800. Charge VISA, MC or mail check, money order for amount indicated plus $4.00 each shipping and handling.

Duplication of copyrighted material is illegal.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 in Miss., outside continental USA **OR** for technical info, order/repair status. 47

MFJ ENTERPRISES, INCORPORATED

921 Louisville Road, Starkville, MS 39759

The Sweet Sounding Repeater

MARK 3CR

A Stradivarius is more than a body, neck, and strings. The name alone says it is an instrument of outstanding quality and beautiful sound.

In repeaters the name for optimum performance and clean, natural sound is Mark 3CR. And Mark 3CR also means:

- Receiver sensitivity <0.25 uV.
- Schmitt trigger squelch to capture fading signals
- 13 Morse messages
- Spurious rejection > 65 dB.
- Autopatch and reverse autopatch
- 15 Function controlled outputs
- Die cast aluminum receiver and transmitter enclosures

For the Finest in

Repeaters • Controllers • Power Amplifiers • Link Transceivers

MICRO CONTROL SPECIALTIES 49

23 Elm Park, Groveland, MA 01834 (617) 372-3442

See List of Advertisers on page 114

ERC SL-55 audio filter is said to improve SSB and CW reception under severe conditions. The unit contains three separate filters: independent and continuously-adjustable bandpass filters as well as a fixed low-pass filter that can be cascaded with the others. The unit generates 1 Watt of audio and has an input/output impedance of 8 Ohms. (Photo courtesy of Electronic Research Corporation of Virgina)

Simple RFI-preventive measures, such as installing an rf choke and bypass capacitor in the recorder's mike and/or auxiliary input leads and bypassing the audio output leads and ac line, will often do the trick, unless you have a very poor station ground or are using a voltage-fed antenna that produces an inordinate amount of stray rf in the shack.

Various patch cords, connectors, switches, and jumpers may be required to conveniently use the recorder with your equipment; these only can be determined after deciding which functions the recorder is to fill. Using shielded cable for all audio connections should go a long way in reducing rf feedback, noise, and hum pickup.

Audio Filters

The congestion on the amateur bands has placed a premium on receiver/transceiver selectivity. Simple fixed-bandwidth i-f crystal filters were good enough for the 40s and 50s, but not good enough to adequately handle present-day QRM conditions. Densely-packed and overlapping SSB stations, closely-spaced CW signals, and RTTY reception through potentially obliterating heterodynes demand complex i-f filters or other means of achieving a high level of receiver selectivity.

Many upper-end receivers of 50s and 60s vintage contained special i-f circuitry using double-conversion techniques to allow the operator to peak the desired signal or null out an offending one. At the time, the best way to improve selectivity on inexpensive receivers was to add an outboard i-f-stage "Q-multiplier," which enabled the operator to either peak a desired signal or null out an offending one by manipulating one of several panel controls. The Q-multiplier (the best-known being Heath's QF-1) was capable of doing a good job, but some practice was required in using it. It went out of favor as the once-standard 455 kHz i-f frequency was largely abandoned for higher and lower i-f frequencies in double-conversion configurations. The transition from tube to solid-state designs also had a lot to do with the Q-multiplier's demise.

The basic means of attaining the desired amount of receiver selectivity today is by means of an i-f stage crystal or mechanical filter. Most high-quality transceivers use a filter with a steep shape factor to reduce out-of-passband signals and noise; the same filter is usually used on transmit. If your receiver or transceiver has provisions for optional i-f filters for reduced-bandwidth SSB and CW reception, it's a wise investment to obtain them—especially the CW filter. Some manufacturers, such as Kenwood, also offer provision for adding a second (dual) SSB filter assembly to further sharpen the response curve and improve the i-f stage's signal-to-noise (S/N) ratio. Addition of the second filter also has a beneficial effect on transmit, allowing a greater degree of speech compression to be used without a significant increase in sideband splatter and resultant bandwidth.

While most i-f filter arrangements don't offer true single-signal reception, those receivers and transceivers that have provision for shifting the center frequency of the i-f crystal filter (variously known as i-f-shift or passband tuning, depending on the manufacturer) offer additional possibilities for minimizing QRM and further improving overall S/N ratio.

Even in those sets having adequate i-f filtering, the addition of an audio filter can enhance performance. The audio filter acts in two ways: 1) It cuts down on the wideband noise generated by the set's i-f chain, preventing amplification by the set's audio stages, and 2) it further narrows the receiver's overall response curve, often allowing true single-signal reception. Both characteristics significantly aid reception when the QRM level is up and when working under weak-signal conditions.

Passive audio filters. A fixed-tuned, passive (non-amplifying) audio filter can do a great deal to improve the selectivity of a receiver, especially one without an i-f filter; in some inexpensive sets, an audio-stage filter is the *primary* selectivity-determining device. Many hams found that war surplus radio range filters inserted in their radios' headphones lead did a good job in separating closely-spaced CW signals, though the filter frequency of most of these units was a bit high-pitched to suit many and receiver tuning and stability became critical when using very narrow bandpass filters.

More sophisticated designs have been developed over the years, using large fixed-value inductors to achieve the desired degree of selectivity at audio frequencies. The radio handbooks are full of good passive filter designs, especially for use on CW. A particularly good one is the six-element L/C CW bandpass filter designed by Ed Wetherhold W3NQN. It appears on page 8-27 of the 1980 ARRL *Radio Amateur's Handbook*. Other W3NQN designs appear in the December, 1980, *QST*. Another practical filter approach is that of Del Crowell K6RIL that appeared in the March, 1968, *CQ Magazine* in his article, "Adding CW Selectivity for Transceivers."

Passive filters are brute-force devices, however; they are lossy—very noticeable if one wants to drive a loudspeaker. Though easy to build, the passive devices rely on large, cumbersome and often hard-to-find toroidal inductors. Also, there is no flexibility in setting the center frequency and bandpass curve or changing these characteristics during operation. A far more satisfactory approach lies in the use of the *active* audio filter.

electronic mail
aerospace
press
satellite
training aids
embassy/diplomatic
maritime
government
emergency/disaster
meteorological
oceanographic
handicapped
civil defense

CONSIDER THE ATR-6800

You know of its reputation in Amateur Radio. But did you know of its world-wide uses in commercial/industrial communications networks? ATR-6800's are communicating over land-lines, via satellite, and on HF/VHF radio links all over the world. They're teaching Morse Code on military bases around the country and operating as TELEX & TWX terminals. We offer engineering expertise for your particular requirement be it Data Encryption, Computerized Training or any special interest. ATR-6800 with 9" video monitor and one plug-in Applications Module . . . $2495. Companion MX-80 printer . . . $699. Contact the "REAL-WORLD" at MICROLOG CORP. 4 Professional Drive, Suite 119, Gaithersburg, Md. 20760. TEL: (301) 948-5307. TELEX: 908778. You'll be pleasantly surprised.

↵51

MICROLOG

INNOVATORS IN DIGITAL COMMUNICATION

↵See List of Advertisers on page 114

Active audio filters. The active, or tuned, amplifying audio filter uses RC networks in conjunction with solid-state amplifiers to *synthesize* the inductor characteristics. The simulated inductance is resonated with a capacitor to produce a tuned-filter effect. What makes this kind of filter so popular with hams is that the filter can be constructed with variable Q and variable center and cutoff frequencies; this allows convenient front-panel control of the filter's operating characteristics that the operator can precisely tailor to suit his mode of operation, personal preferences, and band conditions.

The current spate of solid-state active filter designs are descendants of the classic National Radio "Select-o-Ject" audio filter that was immensely popular about 30 years ago. This tube-type accessory was a handy, quick-and-dirty supplement to a receiver having little real selectivity. Present-day active filters offer a number of specialized features that make them of great interest to both CW and SSB operators.

An active audio filter can be built from one of the many designs regularly featured in the ham magazines; several are in the *Handbook*. At least a dozen firms sell these very cost-effective QRM-suppressors that allow even a modest receiver or transceiver to come to life in the selectivity department, particularly on CW. Manufacturers include Autek Research, Kantronics, M&M Electronics, Datong, Electronic Research Corp. of America, Palomar Engineers, MFJ Enterprises, and several others.

Typical handbook and commercial designs enable operation on either CW or SSB, though a few less-expensive filters are for CW-only or SSB-only use. The majority are self-contained and include their own power supply or draw power from the receiver or transceiver's accessory jack. Most are connected to the set's audio output jack and contain a small internal audio power amp to directly drive a speaker or headphones. The filters enable the operator to adjust selectivity from a few Hz, for razor-sharp CW performance, up to a completely flat response. Many have separate high-pass and low-pass operating modes, especially useful on SSB; others have a deep notch feature that is used to null out an interfering signal or heterodyne without degrading the desired signal. A few sophisticated models allow dual (simultaneous) notching and filtering; at least one model contains a built-in noise limiter.

Using the active filter on SSB is a gratifying experience, especially if in conjunction with a modest set—though top-of-the-line models will benefit as well. By proper control-knob manipulation, it's possible to dramatically improve signal readability under conditions of QRM, static, splatter, and the like—reducing operator fatigue and making listening a great deal more pleasant. SWLs, 10-meter AMers, and CB operators should be interested in the capabilities of the active audio filter, too. Selectivity on the crowded AM shortwave and standard broadcast bands is considerably improved, and stations just a few kHz apart can be separated with little cross-channel interference.

The real thrill comes when using one of these filters on CW. Used in conjunction with a set's existing CW i-f filter, results can be truly impressive. With the active filter, the desired signal can be peaked with an effective bandwidth measured in *tens of cycles*, even in the presence of close-by strong signals that have managed to bull their way through the radio's i-f strip. Even with a sharp i-f CW filter installed, it's possible to actually *tune through* the set's i-f passband with the audio filter and discover several individual CW signals that can be brought up to solid-copy levels that were unreadable or scarcely detectable without the filter. Of course, there is a limit to the degree of selectivity one can crank in; with too much selectivity, filter "ringing" becomes objectionable. Also, using the notch feature, very pronounced unwanted signal rejection (sometimes 70 dB or more) can be attained by proper control manipulation.

Palomar Engineers' CW filter connects between the receiver and a set of stereo *headphones. There are actually two filters, a narrowband one with an 80-Hz bandwidth (centered at 800 Hz) and a wideband one that cuts out hum and high frequency interference but passes most of the receiver audio signal. The narrowband signal goes to one ear, the wideband to the other, giving simulated-stereo reception. The effect is to offer a signal "mix" that is an improvement over either filter alone: The off-frequency signals appear in one headphone, the desired signal in both. The operator's mind concentrates on the desired signal and rejects the interference. Long operating periods are said to be less fatiguing using such an arrangement. (Photo courtesy of Palomar Engineers)*

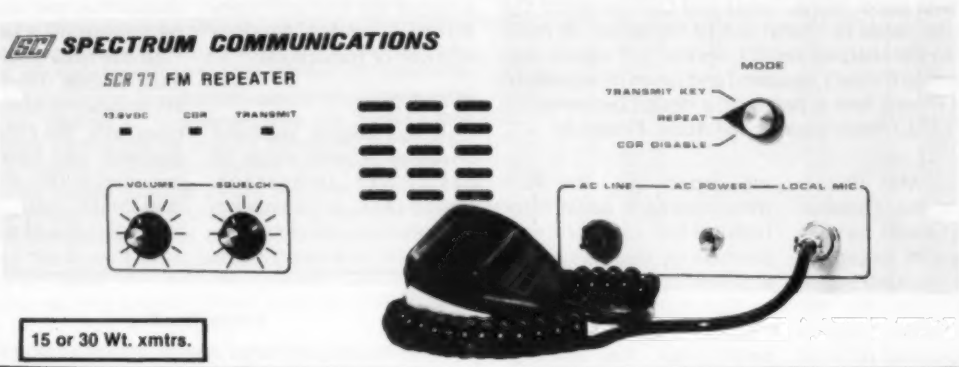
Space-age filtering. A couple of takeoffs on active filtering techniques have surfaced in recent years. One is the concept of simulated-stereo reception,

new

In Repeaters

Some people want the finest, Others want the lowest price.... Now you can have Both!

Introducing the *New Low Cost* Spectrum SCR-77 Repeaters—2M, 220 & 440 MHz!



15 or 30 Wt. xmtrs.

Includes:
- **0.35μV Rcvr. 8 Pole IF Filter**
- **Crystals**—high stability .0005%
- **Local Mic**
- **Your Call programmed into IDer**
- **Provision for Auto-Switchover to Btry. Pwr.**
- **Built-in AC Supply;** basic **Panel Controls, Spkr., LED Indicators**

If you're looking for a new Repeater, but you really don't need (or can't afford) all the features and options on our world famous, 'super deluxe' SCR1000/4000, then our new economy line of SCR77 Repeaters is ideal for you!

These new Repeaters maintain the quality of design, components and construction which made Spectrum gear famous. However, all of the "bells & whistles" which you may not need or want have been eliminated—*at a large cost savings to you!* The SCR77 is a real "workhorse" basic machine designed for those who want excellent, super-reliable performance year after year—*but no frills!* ('PL' 12 Pole IF Filter, Front End Preselector, and a 30Wt. Transmitter are the only "built-in" options available; but Autopatch, Remote Control, and other equipment can be connected via the rear panel jack.)

A complete line of duplexers, antennas, cabinets, cable, etc., is also available.

Of course, if you do want a full featured/super deluxe repeater, with higher power and a full list of available 'built-in' options, then you want our SCR1000 or 4000 "Dream Machine". These units will continue to be available for those who want 'The Ultimate in Repeaters'.

SCR77 Pricing (15Wt.): 2M or 220MHz, **$995.00** Amateur Net. 440MHz, $1150.00. For no 'plug-in' ID board (Export), deduct $40.00. *Call or write today for a data sheet, or to place your order!* Sold Factory Direct or through Export Sales Reps only.

10M FM RX/TX Boards, Repeaters & Remote Bases NOW IN PRODUCTION! Call or Write for Full Info.

¡Se habla Español!

SC SPECTRUM COMMUNICATIONS

68

1055 W. Germantown Pk, S 2 • Norristown, PA 19401 • (215) 631-1710

An "outboard" active audio filter can yield surprising performance benefits in conjunction with even the most expensive receiving equipment. Assuming such a filter is used with a receiver or transceiver having reasonably good i-f selectivity with good "skirts," weak and QRM-plagued SSB signals can be made to "jump out of the noise" in many cases. And in the sharpest modes, several CW signals may be copied within the set's passband and tuned in separately. Autek filter shown here is based on a design pioneered by the firm in 1972. (Photo courtesy of Autek Research)

described by Max Blumer WA1MKP in his October, 1974, *Ham Radio* article, "Enhancing CW Reception Through a Simulated Stereo Technique." In this approach, an active filter is used. Unprocessed receiver audio is fed to one ear, and filtered (processed) audio is fed to the other ear. This technique allows you to read slightly off-frequency CW stations while simultaneously hearing the desired signal, in the clear, in the other ear. The brain does the ultimate filtering—it "hears" all the signals, but the processed signal stands out solidly, with the others mentally rejected. The bottom line is that the filter allows greatly improved reception of the desired signal, but also allows you to hear off-frequency replies to your CQs; it's also easier to scan the band using the simulated-stereo technique. A stereo headphone is required for this type of filter, which is offered commercially by both Palomar Engineers and MFJ.

Especially interesting is the automatic-tracking audio filter offered by Datong. In addition to some impressive narrowband tuning capabilities, the FL-1 frequency-agile audio filter features fast *automatic* suppression of interfering heterodynes in the range of 280 to 3000 Hz by means of its search-lock-and-track notch filter. The tracking notch can be left in the circuit with no audible effect until a whistle appears; the circuit then goes after it and will suppress it within 1 second.

How does it work? Two phase-sensitive detectors control signals used for automatic tuning. One produces a voltage proportional to the degree of mistuning, and the other produces a logic level indicating the presence of a signal within the filter passband. In the absence of such a signal, the integrator becomes a sweep generator. But when a signal is detected, the sweep stops, the unit's lock lamp illuminates, and the integrator becomes part of an automatic frequency control (afc) negative feedback loop. The filter then remains locked to the "captured" signal and will track it, if required, throughout the filter's range of 280 to 3000 Hz. This capability allows the routine use of an extremely narrow (20 Hz) notch which does not noticeably affect received signals and which would be nearly impossible to manually tune and maintain in tune. Of interest to CW ops, an attenuated afc voltage is also used in the manual tuning mode to allow the filter to automatically track *drifting* CW signals over a 100-Hz range!

Whether you opt for a simple or complex filter, you'll likely be glad you made the investment. Dollar-for-dollar, an audio filter is one of the best accessory aids you can buy for your receiver or transceiver.

Wrap-Up

In this article, we have discussed a wide range of basic, yet important, phone-jack accessories: headphones, speakers, recorders, and filters, with a view to obtaining maximum usefulness from dollars spent on station equipment. For most hams, this group of reception accessories probably represents the most important initial accessory investment. For this reason, and for space limitations, we've not discussed exotica which might otherwise fit the article's "phone-jack" scope, such as SSTV viewers, RTTY/Morse decoders, monitorscopes, phone patches, and the like. We'll reserve discussion on these "second-level" accessories until a later time.

In the final analysis, *you* must decide which, if any, accessories to build or buy. Hopefully, the criteria, suggestions, and observations provided in this article will help make your decisions both logical and wise.■

Further Reading

The following reference sources provide additional information, theory, and construction details. Several contain further references to other information sources you may wish to consult:

Jim Ashe, "How to Use Hi-Fi Headphones," *Popular Electronics*, July, 1972.

Ronald M. Benrey, "Adapting Stereo Phones for Hams," *Electronics Illustrated*, May, 1972.

Fred Blechman K6UGT, "How to Use a Tape Recorder in Your Shack," *Electronics Illustrated*, July, 1962.

Max Blumer WA1MKP, "Enhancing CW Reception Through a Simulated Stereo Technique," *Ham Radio*, October, 1974.

Len Buckwalter, "CB Scene" column in *Popular Electronics*, May, 1974.

Richard Humphrey, "Accessories for Your CB Rig," *Popular Electronics*, October, 1973.

Del Crowell K6RIL, "Adding CW Selectivity for Transceivers," *CQ Magazine*, March, 1968.

James R. Kates WB8TCC, "Put a Tape Recorder to Work in Your Shack," *CQ Magazine*, December, 1977.

The Radio Amateur's Handbook, Newington, Connecticut, American Radio Relay League, 1980 edition.

Charles Schauers W6QLV/4, "Ham Clinic" column in *CQ Magazine*, May and June, 1961.

Karl T. Thurber, Jr. W8FX, "Ham Shack Accessories: What You Really Need," *Ham Radio Horizons*, December, 1979.

Karl T. Thurber, Jr. W8FX, "Hi-Tech Gear for Hams and SWLs," *Popular Electronics*, August, 1980.

William G. Welsh W6DDB, "Headsets and Ham Radio," *73 Magazine*, February, 1972.

Edward E. Wetherhold W3NQN, "Modern Design of a CW Filter Using 88- and 44-mH Surplus Inductors," *QST*, December, 1980.

OSCAR ORBITS

● The Amsat Software Exchange has recently been formed and is now accepting orders. The first program being made available is the orbital prediction program written by Dr. Tom Clark W1IWI. It is available for most popular machine environments, with other versions being developed. Presently available are TRS-80 disk and cassette versions, Apple/II diskette, Microsoft BASIC, and PL/I-80. This program will accommodate the elliptical orbit tracking required for the Phase III satellites. For complete information on versions available as well as new additions and ordering information, send an SASE to: AMSAT Software Exchange, Box 338, Ashmore IL 61912.

● The early months of amateur radio's newest satellite, UoSAT-OSCAR 9, were full of developmental work. The Surrey, England-based ground crew concentrated on generating and relaying to the bird a computer program that will allow the craft to stabilize itself via on-board torquing coils and a gravity gradient boom. Once this is accomplished, the experimental part of the mission will commence.

● AMSAT, the people who organize ham radio's space communications program, received a "royal boost" from JY1, Jordan's King Hussein. While visiting the US in early November, the King expressed his support to AMSAT President Tom Clark W3IWI.

● Although the AMSAT financial picture has been brightened by several large donations, there is still a need for grass-roots support by the entire ham population. You can find out more about AMSAT by writing to: The Radio Amateur Satellite Corporation, PO Box 27, Washington DC 20044.

Information for this column comes from the *AMSAT Satellite Report*.

OSCAR 8 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
19928	1	0045:59	79.1
19942	2	0050:31	80.2
19956	3	0055:03	81.4
19970	4	0059:35	82.5
19984	5	0104:07	83.7
19998	6	0108:39	84.9
20012	7	0113:11	86.0
20026	8	0117:43	87.2
20040	9	0122:15	88.4
20054	10	0126:47	89.5
20068	11	0131:19	90.7
20082	12	0135:51	91.8
20096	13	0140:23	93.0
20109	14	0001:43	68.4
20123	15	0006:15	69.5
20137	16	0010:47	70.7
20151	17	0015:18	71.8
20165	18	0019:50	73.0
20179	19	0024:22	74.2
20193	20	0028:53	75.3
20207	21	0033:25	76.5
20221	22	0037:56	77.6
20235	23	0042:28	78.8
20249	24	0046:59	80.0
20263	25	0051:30	81.1
20277	26	0056:02	82.3
20291	27	0100:33	83.4
20305	28	0105:04	84.6

OSCAR 9 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
1778	1	0131:01	157.0
1791	2	0129:57	154.5
1804	3	0110:54	152.0
1821	4	0100:50	149.5
1836	5	0050:47	147.0
1851	6	0040:43	144.5
1866	7	0030:39	142.0
1881	8	0020:36	139.5
1896	9	0010:32	136.9
1911	10	0000:29	134.4
1927	11	0125:45	155.8
1942	12	0115:41	153.3
1957	13	0105:38	150.8
1972	14	0055:34	148.3
1987	15	0045:30	145.7
2002	16	0035:27	143.2
2017	17	0025:23	140.7
2032	18	0015:20	138.2
2047	19	0005:16	135.7
2063	20	0130:32	157.0
2078	21	0120:29	154.5
2093	22	0110:25	152.0
2108	23	0100:21	149.5
2123	24	0050:18	147.0
2138	25	0040:14	144.5
2153	26	0030:11	142.0
2168	27	0020:07	139.5
2183	28	0010:04	137.0

OSCAR 8 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
20319	1	0109:35	85.7
20333	2	0114:07	86.9
20347	3	0118:38	88.1
20361	4	0123:09	89.2
20375	5	0127:40	90.4
20389	6	0132:11	91.5
20403	7	0136:42	92.7
20417	8	0141:13	93.8
20430	9	0002:33	69.2
20444	10	0007:04	70.4
20458	11	0011:35	71.5
20472	12	0016:06	72.7
20486	13	0020:37	73.8
20500	14	0025:07	75.0
20514	15	0029:38	76.1
20528	16	0034:09	77.3
20542	17	0038:40	78.5
20556	18	0043:11	79.6
20570	19	0047:41	80.8
20584	20	0052:11	81.9
20598	21	0056:42	83.1
20613	22	0101:12	84.2
20626	23	0105:43	85.4
20640	24	0110:13	86.5
20654	25	0114:44	87.7
20668	26	0119:14	88.9
20682	27	0123:44	90.0
20696	28	0128:15	91.2
20710	29	0132:45	92.3
20724	30	0137:15	93.5
20738	31	0141:45	94.6

OSCAR 9 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
2198	1	0000:08	134.5
2214	2	0125:16	155.8
2229	3	0115:13	153.3
2244	4	0105:09	150.8
2259	5	0055:05	148.3
2274	6	0045:02	145.8
2289	7	0034:58	143.3
2304	8	0024:55	140.8
2319	9	0014:51	138.3
2334	10	0004:47	135.8
2350	11	0130:04	157.1
2365	12	0120:00	154.6
2380	13	0109:56	152.1
2395	14	0059:53	149.6
2410	15	0049:49	147.1
2425	16	0039:46	144.6
2440	17	0029:42	142.0
2455	18	0019:38	139.5
2470	19	0009:35	137.0
2486	20	0134:51	158.4
2501	21	0124:47	155.9
2516	22	0114:44	153.4
2531	23	0104:40	150.8
2546	24	0054:37	148.3
2561	25	0044:33	145.8
2576	26	0034:30	143.3
2591	27	0024:26	140.8
2606	28	0014:22	138.3
2621	29	0004:19	135.8
2637	30	0129:35	157.1
2652	31	0119:31	154.6

'DATONG'

INCREDIBLE PRODUCTS—REALISTIC PRICES!

WHAT IS AN AUDIO FILTER?
Why buy a Datong audio filter when you can get other audio filters for half the price?
To answer this you first need to remember that the title "audio filter" can mean anything even down to a couple of 741's and a handful of parts. Only by comparing like with like can you make an informed decision. This means comparing features, performance and quality. If you send for our free data sheets and compare our products with the competition, you will see that really there is virtually no competition at our chosen standard of performance.

$149.95

Model FL1

$199.95

Model FL2

What other audio filter can tune into heterodyne interference like tune-up whistles and notch them out, **automatically** like our Model FL1? Yet Model FL1 is also such a good CW filter that it is widely used by professional traffic handlers.
What other audio filter has passband edges sharper than SSB crystal filters and yet which can be tuned at will from 200 to 3500 Hz? To pull off this trick our Model FL2 uses no less than 32 op amps plus state-of-the-art pulse width modulation techniques. Two 5-pole elliptic filters and a 2-pole peak or notch filter in one box, all independently tuneable add up to a lot more filtering capability for SSB, RTTY, CW than you will find in any other "audio filter" that we know of.
To answer our question then, an "audio filter" can be almost anything. On the other hand, the phrase "Datong Audio Filter" is a lot more precise. It stands for state-of-the-art filtering backed by extra capability, extra thorough design and extra quality. If you need confirmation, ask a user!
ADDITIONAL PRODUCTS
Just as our two audio filters set new standards for innovation and invention, our other products demand serious consideration for the same reasons. Each offers a unique combination of features which you will not find anywhere else. We don't have space here for the full story but our data sheets are available free on request. Some brief details follow:

Model ASP: The "smart" rf speech processor
The automatic circuitry in Model ASP senses your voice level and reacts accordingly to always maintain the degree of true rf clipping selected (in decibels) by the panel push-buttons. Novel circuitry avoids "hang-ups" by discriminating against noise spikes and non-speech inputs. Make no mistake, Model ASP connects in the microphone line yet gives true rf clipping for speech enhancement with minimum distortion.

$169.95

Model ASP

Model D70: The go-anywhere Morse Code Tutor
Extracting sixty hours of code practice from a low cost nine volt battery, Model D70 gives you freedom to practice anywhere to suit your timetable and lifestyle. Model D70's variable extra delay between letters is the key to painless progress in code reception. Simply set the "SPEED" control to, say, 12 words per minute and reduce the extra "DELAY" as your ability improves.

$99.95

Model D70

Model PC1: Adds full receive coverage from 50kHz to 30 MHz to any 2 metre all mode rig. Designed for high performance. Model PC1 features LSI synthesisers for 1 MHz steps, parametric mixer for extra good dynamic range, automatic selection of rf preselector filters. Same case style as PL 2 and ASP. Price $239.95

Model DC 144/28: High dynamic range 2 metre convertor
Especially suitable for use with Model PC1 to add 50 kHz to 30 MHz coverage to 28-29 MHz receiver. Uses Schottky mixer, PTH board 5th overtone crystal oscillator. Price $74.95
Model VLF: Crystal controlled converter adds 10 kHz to 300 kHz reception to 28.0 to 28.5 MHz receiver Price $54.95

DATONG ELECTRONICS LIMITED

AR Technical Products Corp
Box 62,
155 S.Bates St.,
Birmingham, Michigan 48012
Telephone 313/644-5888

● **ALL DATONG PRODUCTS CARRY A 90 DAY WARRANTY**
● **VISA - MASTERCHARGE WELCOME**

329

See List of Advertisers on page 114

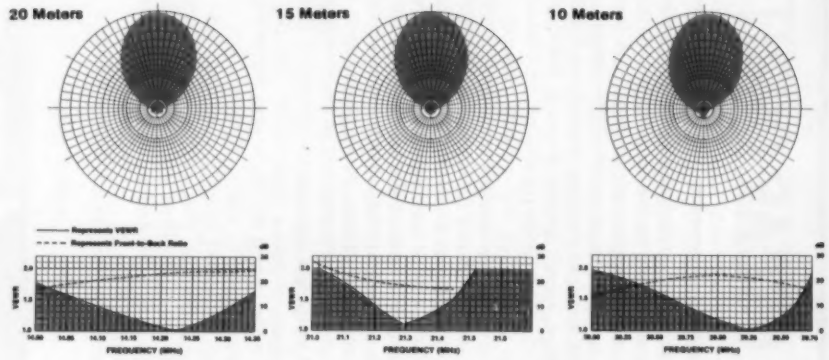
ANNOUNCING
A new standard of comparison for
HIGH PERFORMANCE
TRIBANDERS
the all NEW
hy-gain® TH7DX

BROADBAND WITHOUT COMPROMISE

For years now, whenever hams got together and talked about the performance of any triband antenna, they would invariably compare it to the famous Hy-Gain TH6DXX. Now, there's a new standard of comparison—the NEW Hy-Gain TH7DX. This amazing new tribander, using a dual driven element system, maintains a VSWR of less than 2:1 on all bands, including ALL of ten meters. Hy-Gain didn't compromise on performance to achieve this efficiency either. The TH7DX utilizes a combination of trapped and monoband parasitic elements for more efficient broadband performance. This unique combination produces an *average* front-to-back ratio of 22dB on 20 and 15 meters, and 17dB on 10 meters. The TH7DX, with its great broadband characteristics, is the ideal choice for "all mode" operation.

HIGHEST TRIBAND PERFORMANCE, BUT MANAGEABLE SIZE.

The broadband TH7DX has high performance specifications that meet or exceed the monster antennas that seem to take up most of your real estate and part of



Write for our technical data report and comparative test results.

your neighbor's. However, with its short 20 ft. (6.1 m) turning radius and 31 ft. (9.4 m) longest element, it's no more imposing than a TH6DXX. It's easy to assemble and weighs only 75 lbs. (34 kg). The wind loading is 240 lbs. (109 kg) at 80 mph (129 kph) with only a 9.4 sq. ft. (0.9 sq. m) wind surface area, so the TH7DX is one of the safest and most manageable high performance tribanders you can buy. And, you don't have to spend a fortune on special towers and rotators either.

MECHANICALLY SUPERIOR

In a parasitic array such as the TH7DX, high efficiency traps are used rather than parallel stubs. These Hi-Q traps are capable of handling the maximum legal power with a 2:1 safety margin, and are superior to parallel stubbing for ease of assembly and maintenance as well. In fact, quality materials are used throughout this antenna. Includes 18-8 stainless steel hardware for all electrical—and most mechanical—connections plus taper swaged 6063-T832 thick-wall aluminum tubing. The antenna includes Hy-Gain's BN-86 balun and exclusive heavy, die-cast aluminum, rugged boom-to-mast clamp, and heavy-gauge element-to-boom brackets.

CONVERT YOUR TH6DXX

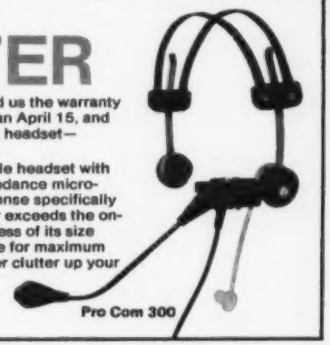
Hy-Gain hasn't forgotten about the thousands of proud TH6DXX owners. A conversion kit is available which offers all of the broadband advantages of the TH7DX and includes a complete stainless steel hardware package. It's easy to assemble, and when completed, you have the finest triband antenna on the market, the TH7DX.

Limited time only

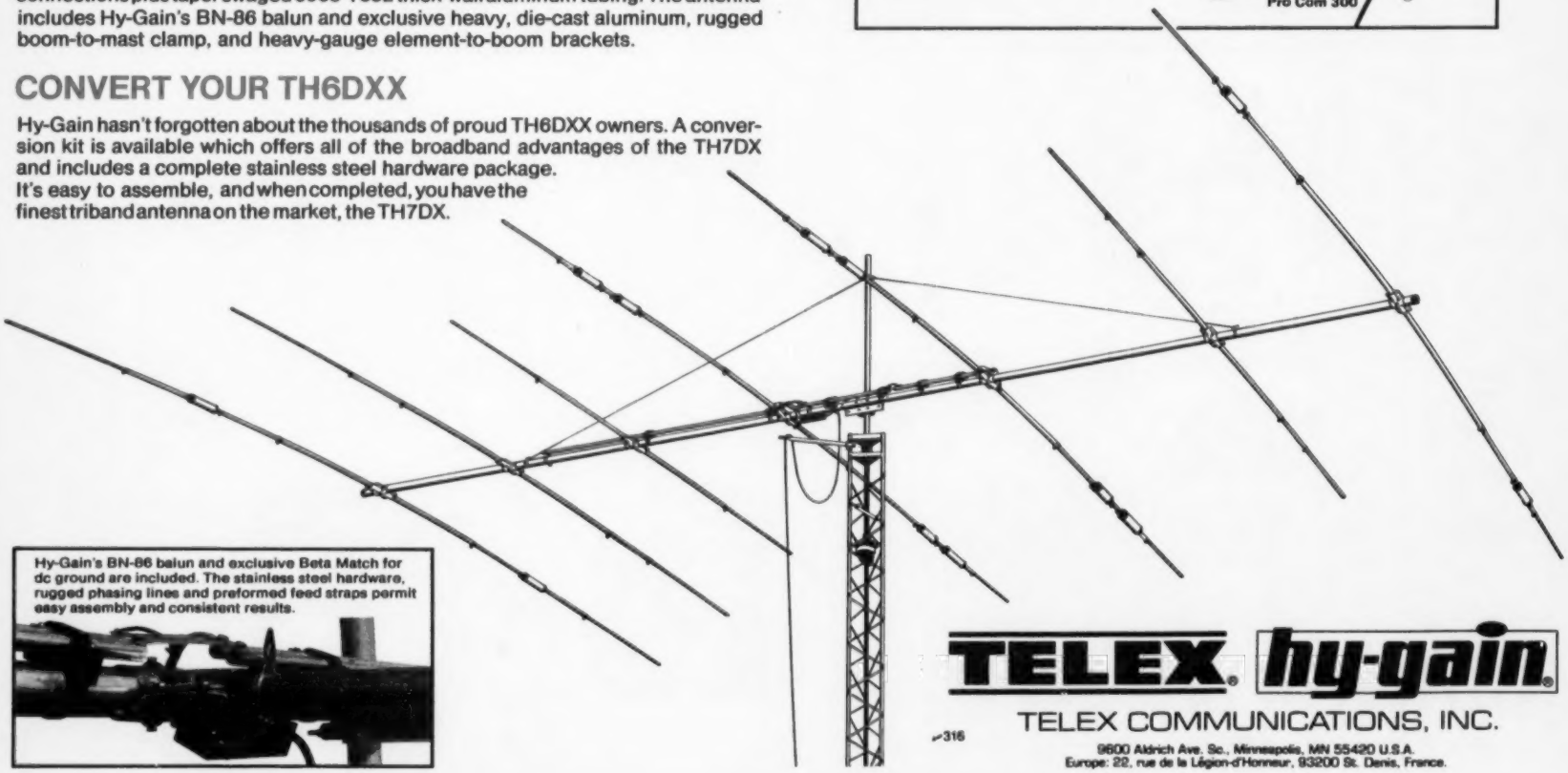
FREE OFFER

Buy the TH7DX before March 31, 1982; send us the warranty card and dated proof of purchase no later than April 15, and we'll send you a free Pro Com 300 boom mic headset—an $89.95 value.

This is an ultralight, single-sided, aviation-style headset with powerful electret microphone. The dual impedance microphone has a 100 to 8000 Hz frequency response specifically tailored to the human voice. And, it equals or exceeds the on-the-air performance of any desk mic, regardless of its size or weight. Leaves your hands completely free for maximum flexibility. Once you've tried it, you may never clutter up your operating area with a desk mic again.



Pro Com 300



Hy-Gain's BN-86 balun and exclusive Beta Match for dc ground are included. The stainless steel hardware, rugged phasing lines and preformed feed straps permit easy assembly and consistent results.

TELEX® hy-gain®

TELEX COMMUNICATIONS, INC.

9600 Aldrich Ave. So., Minneapolis, MN 55420 U.S.A.
Europe: 22, rue de la Légion-d'Honneur, 93200 St. Denis, France.

316

NEW MFJ-312 VHF Converter lets you

HEAR POLICE/FIRE CALLS

and Weather Band on 2 meter rigs. Covers nearly all FCC allocated police/fire VHF-hi freq. (154-158 MHz). Direct freq. readout on synthesized, VFO 144-148 MHz FM rigs.

Now with weather band coverage!

Scanning rigs become police/fire scanner.
Direct freq. readout on synthesized and VFO rigs.

$59.95

Hear exciting police/fire calls, weather band, maritime costal and more on your 2 meter rig!

Scanning rigs become police/fire scanner.

This ingenious MFJ VHF Converter turns your synthesized or VFO 144-148 MHz FM rig into a hot police/fire receiver (154-158 MHz) with direct frequency readout on your rig.

Receive weather plus more on 160-164 MHz.

Feedthru allows simultaneous scanning of both 2 meters and police/fire band. No missed calls.

Enjoy all benefits of your rig such as squelch, excellent sensitivity, selectivity, stability, limiting, AM rejection. For handhelds, too.

Two MOSFETS (tuned RF amp, mixer), bipolar crystal oscillator gives excellent performance.

Bypass/off switch allows transmitting. Won't burn out if you transmit (up to 25 watts) with converter on. Low insertion SWR.

"On" LED. 9-18 VDC. SO-239. Mtg bkt. 3x4x1".

MFJ-311, $49.95. Like MFJ-312 less WX band.

Order from MFJ and try it — no obligation. If not delighted, return it within 30 days for refund (less shipping). One year unconditional guarantee.

Order today. Call toll free 800-647-1800. Charge VISA, MC or mail check, money order for $59.95 for MFJ-312, $49.95 for MFJ-311 plus $4.00 each shipping/handling.

Enjoy exciting police and fire calls, order now.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 for technical information, order/repair status. Also call 601-323-5869 outside continental USA and in Mississippi. ↙47

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

ANYBODY CAN SELL TVRO EQUIPMENT

But Only Our Dealers can sell the right equipment for the right price.

Dealer Single Lot
$1395.00 FOB Hastings

- 12 Ft.
- F/D .375
- Aluminum 24 Section
- Offset Polar mount
- Scaler Horn
- Rotor
- Rotor LNA Mounts
- 41 DB Gain Nominal

COMPLETE SYSTEMS AVAILABLE

HASTINGS ANTENNA COMPANY, INC.

847 W. 1ST ST.
HASTINGS, NEBR. 68901
402-463-3598 ↙18

FOR THE SERIOUS DEALER ONLY

Star View Systems ↙86

H&R COMMUNICATIONS, INC.
Route 3, Box 103G - Pocahontas, Arkansas 72455

Introduces the

MODEL 12K SYSTEM . . .

A complete satellite receiving system that you can assemble yourself as a week-end project.

Why spend $7,000 to $10,000. Why pay someone else to install it. Do it yourself in a week-end and save.

ONLY $2,400.00

UPS SHIPPABLE

50 Channels

KIT CONTAINS

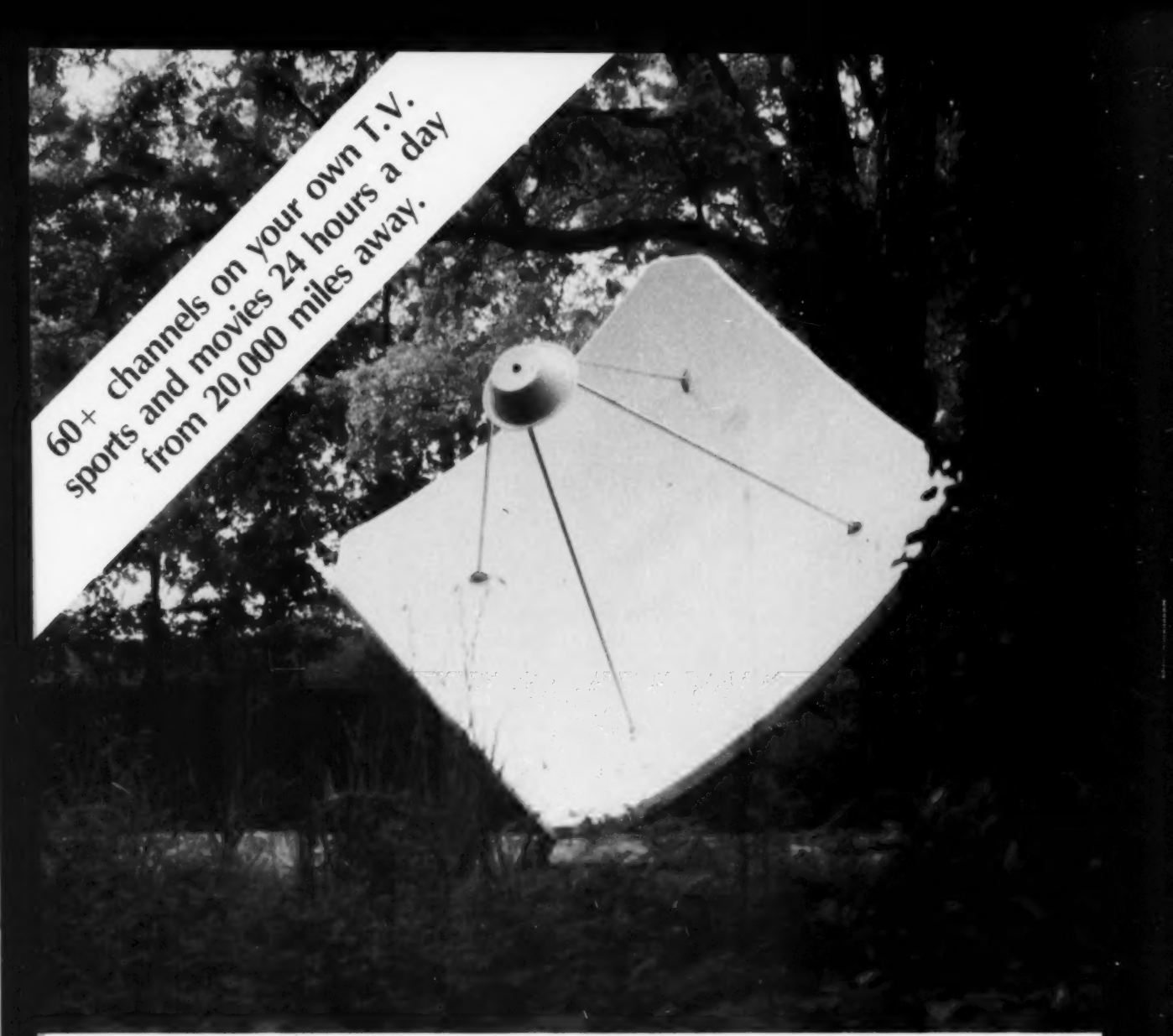
- 12' Antenna
- AZ/EL Mount
- 24 Channel Receiver
- 120° LNA
- Feed Horn

- All Miscellaneous Cable and Connectors Needed
- Everything You Need
- No Special Tools Needed
- Complete Antenna Weight Only 125 Pounds

See Your Local Star View Dealer or Call

800-643-0102 or 501-647-2291

Dealer Inquiries Invited



Birth of a legend

National Microtech, Inc. introduces Apollo™ X9 Satellite Antenna $1995*

National Microtech, Inc. continues to sell more home satellite antenna systems than anyone in the world. Microtech's new Apollo™ X9 is so far advanced over our competition — in features, performance and cost — that we feel Apollo™ is destined to become a legend in the satellite industry.

If you are interested in buying or selling Apollo™ systems, give us a call today.

Remember, no one sells Apollo™ but Microtech dealers and distributors. This special introductory offer is good for a limited time only.

*Suggested retail price, LNA and Receiver not included, Optional Remote Satellite Finder $995.

National Microtech, Inc.

100

1-800-647-6144

In Mississippi 601-226-8432

A Dish Antenna Anyone Can Build

—no hyperbole, just a parabola

Michael Brown W8DIY
6297 Brown Run Road
Middletown OH 45042

Are you contemplating the challenge of operating on the amateur microwave bands? What about getting in on the excitement of receiving satellite TV signals? These and similiar projects usually require a dish-style antenna. You could buy one or, better yet, you can build one. This article will tell you how.

I wanted to put a signal on the 1296-MHz band. To do the job right, I needed a dish antenna. I took the plunge at a hamfest, buying a surplus military job made of spun aluminum, about 6 feet in diameter. It was one of those good deals you can't pass up.

Now my "good deal" sits in the corner collecting dust, waiting to be sold at the next hamfest. I managed to get a signal on 1296 using a dish two meters in diameter that I built myself. The design is one which uses easily-obtained materials and has a total cost of less than $100. Best of all, it need not be a long, involved project. In fact, you can build a dish like mine in a single weekend.

Photos by Tim Daniel N8RK

Photo A. The finished dish is light enough to be moved easily; the author stores his away each winter.

Some Theory

Before we jump into the details of construction, it would be a good idea to look at the basics of dish design. The dish, resembling an oversized child's snow saucer, is a paraboloid. Its unique geometric properties cause it to collect a beamwidth of energy from a distant source and reflect it to a central point known as the focal point, or focus. Similarly, a signal radiated towards the dish from the focus will be effectively radiated by the antenna.

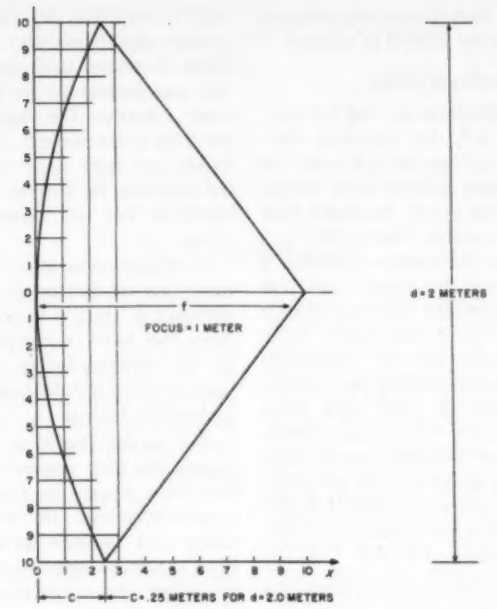
The important dimensions of a paraboloid are shown in Fig. 1. The reason my "good deal" dish turned out to be a piece of junk was that the relationship between the focal point and the diameter was all wrong.

Known as the f/d ratio, this relationship is very important when it comes time to feed the dish. Experience shows that dishes with f/d ratios of 0.5 and greater can be fed easily with a horn-style array. (My commercial dish's f/d ratio was about 0.25 and was difficult to feed.)

The diameter (d) is important in determining how much gain the antenna will have. Obviously, a dish 6 feet in diameter will collect more signal than a 3-foot dish. Each time you double the diameter, the gain increases by a factor of four (6 dB). The actual gain of a dish depends on its efficiency and the frequency it is used on. Assuming a reasonable efficiency of 50%, a 2-meter dish should have about 25 dB of gain over a dipole source at 1296 MHz. The 3-dB beamwidth will be about 8 degrees. Fig. 2 shows these relationships.

Once you have chosen the desired diameter, you'll know where the focal point should be to achieve an f/d ratio of about 0.5. In the case of a 2-meter dish, f will be at one meter.

The exact curvature needed to obtain a paraboloid with the desired focus and diameter can be found using the equation $y^2 = 4fx$. By calculating a number of points for x and y, you'll have an accurate plot of the shape required. Let's try an example for a dish with the focus at one meter: The x value corresponding to the y point of 0.5 is found by solving the equation $0.5^2 = 4(1)x$. A little algebra yields: $x = 0.5^2/[4(1)]$.



$y^2 = 4fx$

y = 1, x = .25	y = .5, x = .0625
y = .9, x = .2025,	y = .4, x = .04
y = .8, x = .16,	y = .3, x = .0225
y = .7, x = .1225	y = .2, x = .01
y = .6, x = .09	y = .1, x = .0025

Fig. 1. Dish dimensions. Width (c) is found by solving: $f = d^2/16c$.

Punching the calculator keys, we come up with the answer x = 0.625 meters. Fig. 1 also shows that the total width of the dish, c, is found with the equation $f = d^2/16c$.

That's all there is to designing the reflective part of the dish. Now let's look at how to build it. For starters, you should be prepared to work with metric measurements of length. I found that the use of meters and centimeters helps to ensure accurate results. For noncritical measurements, we'll refer to English units.

Once you have a set of x and y values, it is time to fabricate a surface that accurately depicts them. Any irregularities will impair the antenna's gain. At 1296 MHz, deviations of up to 1.5 cm are tolerable. As the frequency increases, this tolerance decreases. Using care, this dish can be built with deviations of less than 0.5 cm.

Making the Ribs

The structural elements that give the dish its strength and special shape are eight wooden ribs. I made mine from scrap 3/4-inch white pine. Each rib was cut from a 40" × 14" piece. Any available substitute should work, provided that it is reasonably light and can be cut to the needed shape.

Carefully draw a center line lengthwise, 5.8 cm from one edge of the board, as shown in Fig. 3. Work from this line to lay out a parabola, using the points generated by the $y^2 = 4fx$ equation. The more points you use, the more accurate your paraboloid will be. Carefully draw a line to connect the points on the inner surface. The outer surface should have a shape like the one shown. The lower flat edge will be at the center of the dish, while the upper end will be at the edge, fastened to a ring of aluminum tubing.

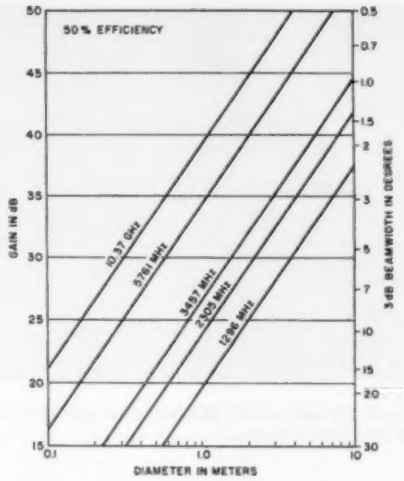


Fig. 2. Dish diameter/gain relationship.

After checking the layout, the eight ribs can be rough-cut to about 0.2-cm accuracy using a band or saber saw. Final trimming should be done by sanding. Be sure to keep the flat edge parallel to the center line.

The ribs are all joined at the dish's center by a 3/4-inch-thick plywood mounting plate like the one shown in Fig. 4. Ribs A and B are mounted first, using 1-1/2-inch wood screws. All the other ribs must be shortened to obtain equal inside diameters. Ribs C and D have 3/8" removed from the inside end. Ribs E, F, G, and H are shortened 3/8" and mitered with two 45° angles as shown in Fig. 4(a).

Finally, all the remaining ribs are fastened to the mounting plate, first with glue and then with wood screws.

To add strength to the dish's outer edge, I encircled it with 1/2-inch aluminum tubing. Four six-foot lengths were used. To bend the tubing into a circle, one end is plugged, then the tube is filled with sand and carefully bent into shape. This was easier to accomplish than I thought it would be. An undersized piece of tubing is used for coupling between the sec-

Photo B. A feedhorn can be easily constructed. The pickup is a simple, monopole element.

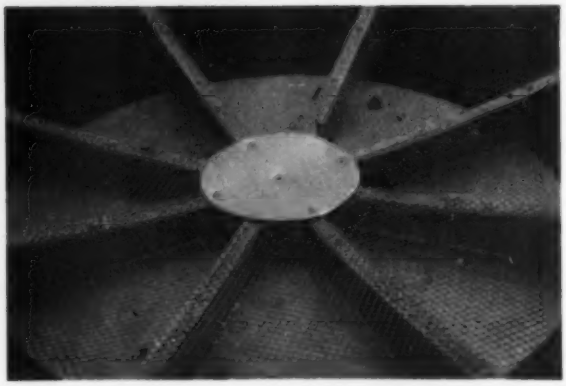


Photo C. A circular plate holds the reflective screening in place at the dish's center.

tions. The shaped lengths are fastened to the dish perimeter with 5-cent conduit clamps as shown in Fig. 4(b). Since the ribs give the dish its shape, getting the outside circle perfect is not necessary.

Covering the Frame

The next step is to cover your frame with a reflective surface. I used 1/4-inch hardware cloth because it was cheap and available.To make the job easier, I cut the cloth into eight slightly oversized triangles. Staple a triangle between two adjoining ribs and then trim the excess outer edge to size. Next, tie-wrap the perimeter to the aluminum tubing using nylon cord with cable-wrapping technique. Be sure to wear gloves when working with the hardware cloth.

Once all the screen is in place, eight flathead screws are used to hold it on each rib. (The staples are no longer needed and can be removed.) Since eight layers of hardware cloth overlap at the center, they must be trimmed and then securely fastened beneath a seven-inch diameter disc.

At this stage, all the essential parts of the reflector are complete. Since my dish is going to be mounted in an exposed location, I decided to strengthen it by adding bracing between the ribs about midway from the center. A framework was fastened to the center plate so that the whole antenna can be bolted to a mast.

Feedhorn Ideas

Because of the f/d rati of 0.5, the obvious fee choice becomes a horn. The theory behind horn design is not trivial. To make matters worse, there often is a vast difference between a design on paper and one that works. The horn shown in Fig. 5 has been field-proven on the 1296-MHz band by K9KFR and others. Horns of this type have about 8 dB of gain. Other types of feeds can be used; one good source of information is the RSGB book, *VHF-UHF Manual*, by Jessop and Evans.

Unless you can find a tin can that meets the dimensions shown in Fig. 5, you will need to make one. Using light-weight aluminum stock, I made a cylinder from a 18" × 28.25" piece. Next, a cap is fashioned to fit into one end. Small vee-shaped tabs are bent 90° and riveted to the cylinder wall. The result is a tube with an inside length of 16" and a diameter of 9".

The location of the tuned element is critical. A type-N connector should be mounted 2" from the rear wall. A 1/4-wave driven element (1.8" of 1/4-inch copper tubing or 1/8" welding rod) is adjusted by filing. Using approximately one Watt of power with an in-line wattmeter, file for best vswr. *Caution: The horn is emitting microwaves; keep hands and eyes away from the opening.* Be sure to use hardline for all connections.

It should come as no surprise that at this point the antenna is almost finished. Now the horn is mounted on the antenna frame with four sections of telescoping aluminum tubing.

The exact distance between the dish center and the horn must be found experimentally. The focal point will *not* be at the horn's outside edge, it will be inside the cylinder. To find the exact focus, the dish should be aimed at a signal source and the horn moved up and down until the received signal is at a maximum. If your 1296 receiving gear includes a low-noise amplifier, then one excellent signal source is "sun noise." Aim the dish at the sun, and your receiver should give a noticeable output.

The antenna's polarity is determined by the position of the driven element. Rotating the horn 90° changes the antenna from vertical to horizontal or vice versa. When the driven

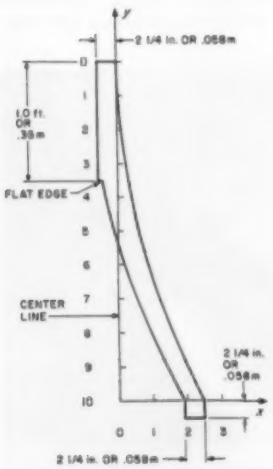


Fig. 3. Rib detail.

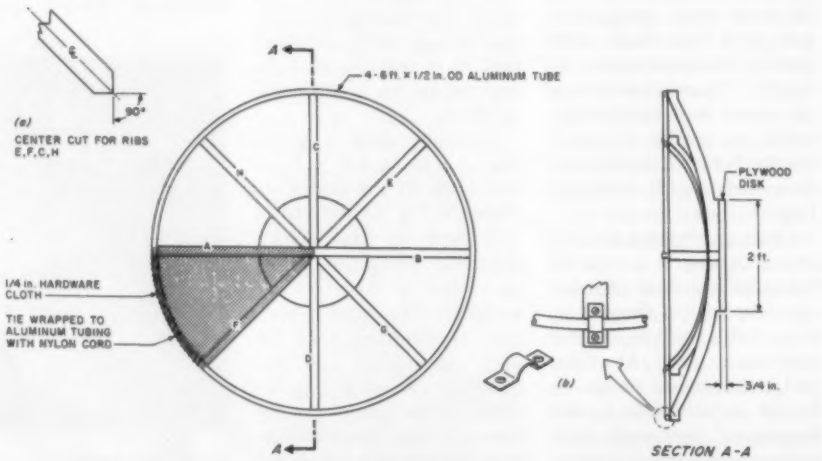


Fig. 4. Assembly of the ribs.

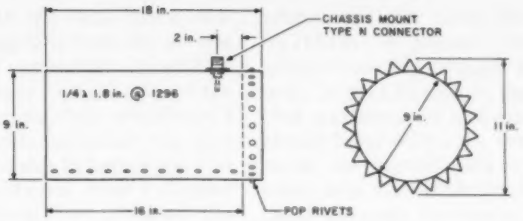


Fig. 5. Feedhorn design.

element is horizontal relative to the Earth, the antenna is horizontally polarized and is set for 1296-MHz tropo operation. Once the focus and polarity are set, bolt everything into place and start enjoying your new antenna.

Life on 1296

You might be interested in the rest of my 1296-MHz station. For receiving, I use a preamplifier made with an MRF901 transistor, followed by a Microwave Module that converts the signal to 28 MHz where an amateur transceiver is used. On transmit, a home-brew varactor tripler provides 3/4-Watt output on 1296 when driven with a ten-Watt, 432-MHz signal. This may not seem like much power, but I make the most of it by using hardline between the dish and the shack. Thanks to my dish antenna, the 1296 effort has been a success. The first two contacts were with K9KFR and WA8JHW, each more than 100 miles away.

This article is being written in the winter, and the dish has been stored away, safe from ice and other hazards. When warm weather returns, you can be sure that W8DJY will be back on 1296. In the meantime, plans are being made for a much bigger dish and a more powerful transmitter.

As you can see, building a dish need not be difficult. This project was the result of a lot of help and ideas from fellow VHF-UHF enthusiasts, including WB8EEX, whose garage proved invaluable, W8ULC, who handled the fancy footwork on the tower, and K9KFR, who patiently helped get a feed that worked.

About the only thing that can't be changed is the basic parabolic shape. Make the most of the materials that are available in your area; be brave; experiment! If you have questions, please include an SASE. See you on 1296! ■

Photo D. Building a 1296-MHz dish need not be difficult, but it will require some home-brewing.

ESR24 Earth Station Receiver

Full-performance Satellite TV Receiver

• All 24 Satellite Channels • Attractive Styling • Digital Display • Up/Down Channel Button Control
• Fixed and Variable Audio Tuning for all Subcarriers • Normal/Inverted Video Switching
• Signal and Tuning Meters • Single and Double Down Conversion Models • Afc for drift-free operation
• Remote Control and Remote Metering Options • Suggested List as low as $995.00

Write for brochure or see your dealer.

R. L. DRAKE COMPANY DRAKE

540 Richard St., Miamisburg, Ohio 45342, USA
Phone: (513) 866-2421 • Telex: 288-017

Richard Christian WA4CVP
Rt. 1, Box 209-W
Creola AL 36525

S. F. (Mitch) Mitchell, Jr. WA4OSR
PO Box 973
Mobile AL 36601

Job's Own LNA

— rolling your own takes patience

Yes, it *is* possible to home-brew a workable LNA (Low Noise Amplifier) for your home-brew satellite TV receiver! But to do it, you must have the patience of Job and start with a full head of hair!

We'll let you, the reader, decide as you read the article just how much patience we have.

In ham radio receiver terms, the LNA is the "front end" of the satellite receiver. Commercial units generally have about 40 to 50 dB of gain at 4 GHz. They usually are constructed of one or two stages of GaAsFET transistors and several stages of bipolar transistors to achieve the amplification desired. The GaAsFET transistors are a special type of transistor with a very low noise figure. They get their name from the material used to achieve the low-noise figure, gallium (Ga) arsenide (As).

This article describes the trials and tribulations that we went through in building the LNA for our satellite-TV receiving system. Although we had access to absolutely no test equipment for 4 GHz until after it was known to be working, we were very successful in getting the complete system going. We wish to share our hard-earned information with *73* readers who are considering building their own systems.

First, a little history. Our initial attempt to build an LNA used a commercially-available board which, for reasons to be discussed, will be nameless. The board was supposedly designed to work with Nippon Electric Company (NEC) NE21889 GaAsFETs. These FETs are expensive at $103.25 for two, but they have a noise figure of 1.2 dB at 4 GHz. So, being the scroungers that we are, we attempted to substitute cheaper (higher noise figure) GaAsFETs. The result was two blown FETs that cost $62.50 and two grown men crying. We then bit the bullet and ordered two of the NEC FETs from its US distributor, California Eastern Labs (CEL).

With cold, dry weather, we were in a real dilemma. How do you protect a hundred bucks worth of minute transistors from static electricity while you are soldering them into the circuit? We finally decided that we needed a work area with a good ground and high humidity. Richard's front bathroom was selected to be converted to a reduced static work area. We turned on the hot water in the shower to steam things up.

A piece of copper braid wrapped around my wrist and grounded to the cold water pipes provided the ground needed. A large piece of copper-covered PC board also was grounded to the cold water pipe and was used as the work surface. We let the soldering pencil

©MARTCOMM, INC.
1981
ALL RIGHTS RESERVED.

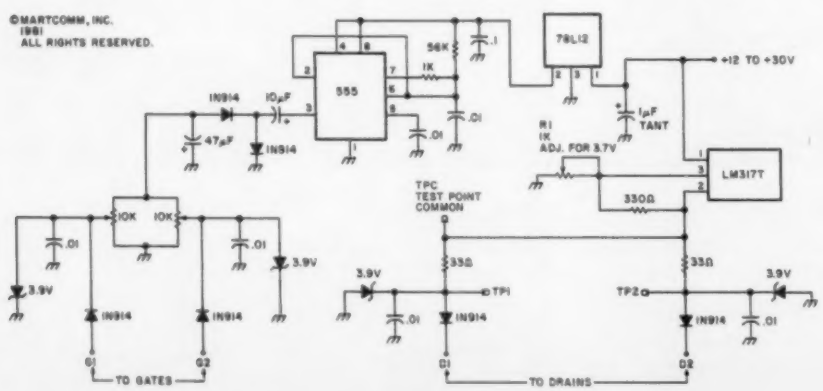


Fig. 1. Bias supply schematic.

heat up and then unplugged it from the ac line and grounded it with a jumper to the work surface for more static protection. I quickly soldered the first transistor in before the iron could cool. After I stopped shaking, we reheated the soldering pen and I soldered in the second transistor. It's amazing what lengths you will go to when a hundred dollars worth of FETs are at stake.

The LNA was mounted in a box made of double-sided PC board, with feedthrough capacitors supplying the correct operating voltages from a very simple resistive divider power supply. Next, we gave the LNA a try. It wailed like a banshee! In other words, it acted more like an oscillator than an amplifier.

How did we tell that it was oscillating without using test gear? We discovered that any oscillation within the 3.7-to-4.2-GHz band is immediately obvious on a TV connected to the receiver. If the oscillation is strong, there will be very prominent black bars on the screen regardless of where the local oscillator is tuned. If the oscillation is weak, there will be a very weak but still visible black bar. Black bars will occur twice, 70 MHz apart, within the tuning range of the local oscillator, if you are using a single conversion receiver (since you get both the signal and its image).

If the oscillation is outside the tuning range of the TV, however, it will not show up on the TV screen. If you can't see it on the TV and if you don't have a spectrum analyzer to test with, how do you know that it is still oscillating? Noise, noise, and more noise at the 70-MHz i-f stage.

What to do with the oscillating LNA? Start over! We wrote California Eastern Labs for their Application Note AN80903 that describes an LNA using the NE21889s. A prompt response from CEL brought it to us. In the CEL design, the LNA was mounted in a machined-brass enclosure. We could not immediately locate any half-inch-thick brass to make the enclosure, but Richard, scrounging through his junk pile, located a short piece of copper bus bar which was suitable. A little persuasion was applied to a local machine shop and presto, we had two nice machined-copper enclosures.

Since we thought it would be impossible to remove the GaAsFETs from the first LNA board without destroying them, we ordered two more NE21889s from CEL. At $103.25 for the pair, this project was getting expensive!

Richard arranged for a local print shop to make negatives for the printed circuit board to within .002 inch of the dimensions specified in the CEL Ap Note. We quickly made a board and waited for the second pair of transistors to arrive.

While waiting for the transistors, we did some serious thinking about a power supply for the LNA. As previously mentioned, we had already zapped two "cheap" FETs. We wanted a reliable LNA power-supply design that would protect the expensive little buggers. Many hours of design, building, and testing of circuits by Richard resulted in the LNA power supply board described here. We call it our "How Not to Gas Your FETs Bias Supply Board." It was designed specifically for a two-stage LNA using the NEC 21889 FETs.

Some criteria for the design: It should—

- Supply +3 volts for the drain and −3 volts for the gates.
- Power two stages of GaAsFETs.

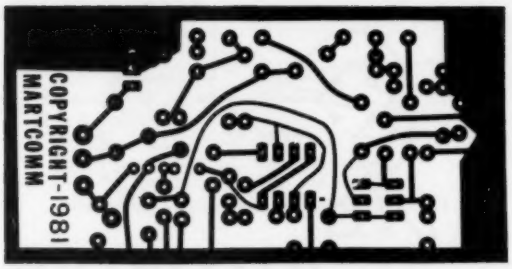


Fig. 2(a). PC-board layout.

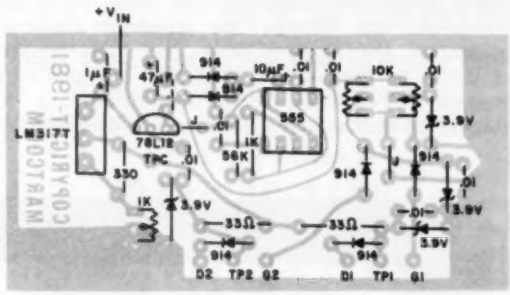


Fig. 2(b). Parts placement.

- Require only one pair of wires for the LNA so the supply voltage, with proper blocking, could be carried on coax cable.
- Provide reverse polarity and overvoltage protection for all gates and drains.
- Regulate gate bias and drain voltage with a main-supply voltage falling anywhere between +15 and +30 volts.
- Have most parts available from Radio Shack.

The circuit described in Fig. 1 meets all of the design criteria. The input voltage, which can be from +15 to +30 volts, is applied to an LM317T adjustable voltage regulator, which reduces it to +3.7 volts. The +3.7 volts is then filtered by a 1-uF tantalum capacitor and fed through 33-Ohm current-limiting re-

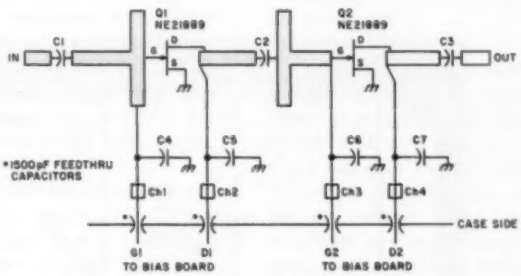


Fig. 3. Typical GaAsFET amplifier schematic.

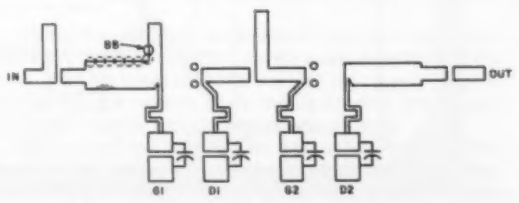


Fig. 4. Typical LNA board layout (not to scale).

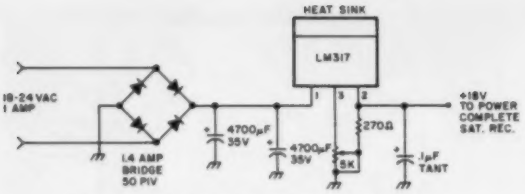


Fig. 5. Receiver power supply schematic.

sistors to the drains of the two GaAsFETs. The test points on each side of the 33-Ohm resistors are used to measure the voltage drop across the resistors and, therefore, the current being pulled by each FET. A voltage drop across the resistor of .33 volts equals 10 milliamperes of current being pulled by the FET. A 3.9-volt zener diode limits the maximum drain voltage, and high-frequency filtering is provided by the .01-uF capacitors. The voltage is then fed through 1N914 diodes for reverse voltage protection. This completes the drain supply.

We decided to generate the required negative voltage from the positive supply instead of going with a bipolar supply. Past experience has proved that for us, the negative-voltage regulator always fails first. With no negative bias, high-drain current would probably result, zapping the expensive FET. For the gate supply, the +15 to +30 volts is applied to a 78L12 regulator. The regulated +12 volts is used to supply a NE555 timer IC configured as a free-running multivibrator. The output of the 555 is rectified with a voltage doubler and filtered to give a negative voltage for the gate bias. The negative voltage is applied to two 10k-Ohm ten-turn pots. The zener overvoltage, diode reverse-polarity protection, and high-frequency filtering are the same as for the drain supply. A PC-board layout and parts overlay for the LNA power supply are shown in Fig. 2.

Everything was now ready for the arrival of the second pair of FETs. When they arrived, Richard soldered them in using a Radio Shack battery-powered, isolated-tip soldering pen that we had purchased for working with the GaAsFETs. By having Richard solder these in, we discovered that the guy who supplies the money for the FETs shakes the most when soldering.

After assembly of the bias supply board, but before connecting it to the LNA, apply +15 to +30 volts. With a voltmeter, adjust pot R1 for +3.7 volts at the test point TPC (Test Point Common). This will result in approximately +3 volts to the drains after the .7-volt drop across the reverse-polarity protection diodes. Set the 10k bias pots for −3 volts at points G1 and G2.

The supply is now ready for connection to the LNA, using the isolated-tip, battery-powered soldering iron, with the tip grounded to the LNA board. Refer to the "typical" LNA schematic, Fig. 3. Be *very careful* to connect the gate leads, G1 and G2, before connecting the drain leads, D1 and D2. With a voltmeter across the 33-Ohm resistor, + probe to TPC, − probe to TP1, adjust G1 bias for a .33-volt reading. This indicates that 10 milliamperes of current is being pulled by the

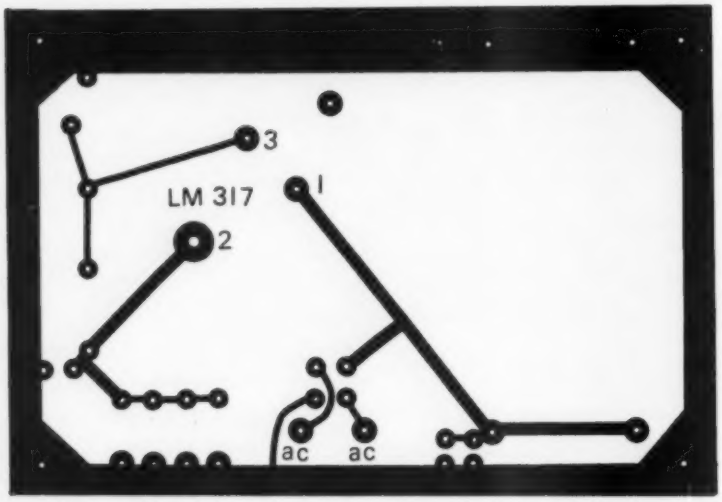


Fig. 6(a). Receiver power-supply PC board layout.

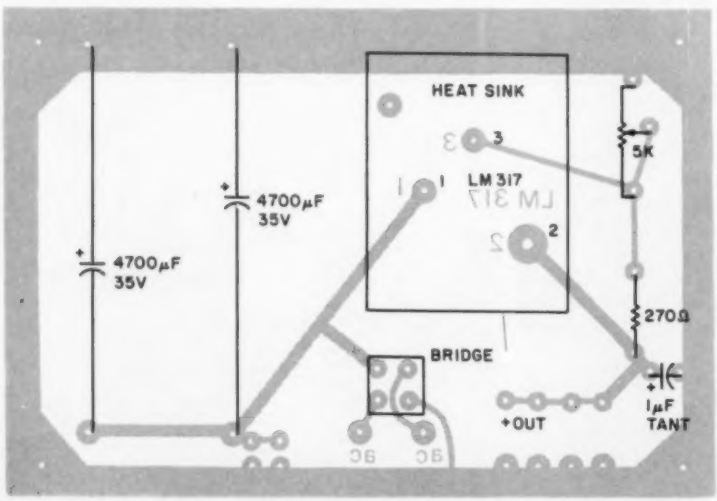


Fig. 6(b). Parts placement.

GaAsFET. Move the − probe to RP2 and adjust the G2 bias pot for a .33-volt reading. Now go back and check FET #1. As you adjust the bias pots, the current should *evenly increase*! If the current jumps or is erratic, the LNA is probably oscillating. How to stop oscillation is the subject of another article!

Using the above-described LNA power supply and tune-up procedure, the CEL LNA design came up beautifully, with no oscillation. Its two stages gave a solid, measured 21 DB of gain. We were unable to measure the noise figure directly, but the fellow with the test equipment said that it appeared to be very low, based on his evaluation of the ratio of gain to noise generated by the test equipment.

What type of picture do you get with a two-stage, 21-dB gain LNA that has an unknown noise figure? Very poor! After getting the first CEL LNA working, Richard was able to remove the NE21889s successfully from the commercial board. We built up a second board, using the cell design and our LNA power-supply board. Again, the CEL design came up with absolutely no problems. Now, by cascading the two boards, we were getting some results.

After optimizing the boards, which I will cover next, we have numerous transponders on SATCOM I above noise. We are located in the 32-33-dB footprint and the antenna is a home-brew 12-foot spherical. We have made comparisons of our four-stage CEL LNA and a 120-degree commercial LNA. Our home-brew LNA compares *very favorably* with the commercial unit.

Trimming an LNA for Best Noise Figure and Best Gain

After having gone through the misery of trying to build an LNA with almost no information and absolutely no test equipment, we now can describe some of the procedures we had to discover the hard way.

The first step is to prepare a work area so that you minimize the possibility of blowing those costly GaAsFETs. A piece of printed circuit board makes an ideal work surface. Again, you will need a good isolated-tip soldering pen. Ground the tip of the pen to the work surface with a jumper. The battery-powered pen sold by Radio Shack works great. You should ground yourself to the work surface with a piece of copper braid. You also will need an X-acto® knife, a BB or small ball bearing, a plastic tuning wand, and a steady hand. Glue the BB or small ball bearing to the end of the plastic tuning wand.

The LNA, as built, should produce watchable video in most areas of the country. With power on and a transponder tuned in, make sure that the correct current is set for each stage of the LNA (10 mA per stage for the NE21889). You should monitor the current of each stage as it is trimmed. Place the BB on the PC-board trace edge as per Fig. 4. Slowly move the BB around the outside perimeter of the striplines, keeping it in contact with the stripline. Monitor the quality of the received picture as you move the BB. When a point is found where the picture quality gets better, you need to add copper to the stripline. If the picture quality gets worse, you need to remove some of the stripline by making *very* light cuts. We only score the copper with the X-acto knife so that it can be soldered back together if needed. Make several trips around the striplines and note the effect before doing any adding or trimming. Make a log of the points where changes occur and see if they repeat each time you run the BB by them. After you are convinced of the points that need changing, then make the necessary adjustments. Copper can be added by salvaging a piece of foil from another piece of PC board or by using GC Electronics Silver Print paint.

After the adjustments are made, make a slight increase in the current for each FET stage while watching the picture quality. We have run the current up to 40 milliamperes on a stage with no oscillation. The first stage will probably have to operate at 8 to 12 milliamperes for best noise figure. Successive stages can operate at higher current levels for more gain.

The basic power-supply design (Fig. 5) and PC board layout (Fig 6) power the bias board and also our complete satellite TV receiver. There is nothing special about it except, again, that an effort was made to use parts available from Radio Shack.■

Printed circuit boards are available from Martcomm, Inc., PO Box 74, Mobile AL 36601, for the power supplies and the LNA. The LNA board is $20.00, the LNA bias supply board is $12.00, and the receiver power-supply board is $10.00. Add $1.75 per order for first class postage.

You may request the CEL LNA Application Note AN80903 by writing to California Eastern Labs at 3005 Democracy Way, Santa Clara CA 95050. A copy of the Note is supplied with each LNA board ordered from Martcomm, Inc.

SATELLITE TELEVISION SYSTEMS

WE WILL NOT BE UNDERSOLD!!
Complete Systems, Antennas, Receivers, LNA's & Accessories
CALL US TODAY! ⌐320
812-238-1456

hoosier electronics

"Nation's Largest Total Communications Distributor"
P.O. BOX 3300 • TERRE HAUTE, INDIANA 47803

⌐See List of Advertisers on page 114

Billy L. Nielsen WB4APC
Rte. 2, Box 253E
Radcliff KY 40160

Microwave Master

—you might not need a mountaintop

With the growing interest in satellite television reception, weather picture reception, and higher frequency utilization, the need for a better understanding of microwave principles becomes more important than before.

To better understand microwave techniques, we must first understand the frequency bands and the characteristics of the microwave spectrum in relationship to other lower frequency radio waves. As we know, radio waves travel mostly along the ground path and are not readily affected by mild changes in the weather or atmosphere. When we get into the microwave region, the characteristics are entirely different.

To begin, let us take a look at what microwaves are. Radio wayes above the 1000-MHz level are called microwaves. It is a common practice to relate to this portion of the frequency spectrum in terms of Gigahertz (GHz), with a frequency of 1000 MHz being equal to one Gigahertz. The basic spectrum of microwave frequencies is made up of three very basic bands. These bands are: the S-band centered at about 3000 MHz (10 cm), the X-band at about 10,000 MHz (3cm), and the K-band at about 27,000 MHz (1.1 cm).

Table 1 shows the relationship between the bands by wavelength in both centimeters and inches, and Table 2 shows some of the services operating there. You will notice from the table that a full wavelength at the microwave frequencies is not very long. When we get into working with the construction of microwave equipment and subassemblies, these measurements will have a very significant meaning.

The first cavity magnetron was developed in Great Britain in 1940, after the publication in 1936 of two papers on hollow waveguides. These papers are: "Hyper-frequency Waveguides—General Considerations and Experimental Results" by G. C. Southworth, and "Transmission of Electromagnetic Waves in Hollow Tubes of Metal" by W. L. Barrow. During the period of early development around 1940, most of the experimental work was carried on in the Radiation Laboratory at the Massachusetts Institute of Technology. During this time, almost all experimental work in microwaves was directed towards the design and use of microwave radar equipment, due to the small size of antenna equipment required in the microwave region.

After the second world war, more efforts were made in other areas to the extent that today, almost all long-range telephone communications are relayed by microwave links. As scientific advances began in outer space, the role of microwaves became even more important. In fact, microwave technology has made possible many of the products used today in our homes, business, and in private industry. An example of a modern use of microwave technology is the microwave oven found in many homes and businesses.

Microwaves are also used in many of the security alarm systems found in business use and have been used by private industry for some time for cleaning of parts, removal of broken screws and bolts, and for controlling signal devices at railroad crossings and drawbridges. Another use with which almost everyone is familiar is the radar speed control devices used by police forces all over the country.

To understand microwave principles, we must first take a look at some of the characteristics of microwaves in relation to other forms of radiation. We must also learn what variables affect the microwave signal itself.

To begin, microwaves normally travel in one or all of four basic paths. These four paths are direct wave, reflected wave, surface wave, and sky wave. In most microwave installations, the direct wave is the desired path, although the reflected wave also may be of importance in some instances.

The direct wave is so named because of its direct path from one point to another. With optimum conditions, the most reliable communications can be ob-

Band	Frequency (MHz)	Wavelength cm	Wavelength inches
S-band	3,000	10	4
X-band	10,000	3	1.2
K-band	27,000	1.1	.44

Table 1. Microwave bands.

Service	Frequency	Wavelength cm	Wavelength inches
Amateur	1296 MHz	23	9.1
WEFAX	1691 MHz	17.8	7
MDS TV	1900-2500 MHz	15.8-12	6.2-4.7
Satellite TV	3700-4200 MHz	8-7	3.2-2.8

Table 2. Some services operating in the microwave frequencies.

tained through the use of the direct wave.

The sky wave normally is considered to be a wave that has been reflected from the ionosphere, a region that extends from an altitude of approximately 30 miles on out to about 250 miles. In the area of satellite television or weather fax, a signal which is transmitted from a satellite is not considered to be sky wave but, instead, falls under the classification of a direct wave that has been retransmitted.

Surface waves are waves that travel along the surface of ground or water. They are mostly predominant at the lower frequencies. At microwave frequencies this mode of propagation is usually insignificant and in most cases may be disregarded.

The reflected wave is a wave that has been reflected from the land or water surface of the area between the transmitter and receiver antenna sites. A factor that determines the strength of the reflected wave is the type of surface that the wave is reflected from. Land is considered to be a poor reflector and will scatter the wave in many directions. Water is a good reflective surface and generally will reflect the entire wave in one direction. The reflected wave is only important when the reflected signal is picked up at the receiving antenna with a strength comparable to the strength of the direct-wave signal. At this particular occurrence, the reflected wave may either boost the direct-wave signal or cancel it almost completely. The determining factor at this time is whether the two signals are in phase with each other. If the two signals are in phase, or nearly in phase, or if the two signals are of nearly equal strength, the combined signal can be twice as strong.

However, if the two signals are nearly 180° out of phase with each other, there will be a reduction in signal strength since the reflected signal will cancel some of the strength of the direct-wave signal.

A phase difference between the direct wave and the reflected wave is usually introduced by the difference in the distance each wave travels. This difference may vary from installation to installation and can be anything from a fraction of a wavelength to many wavelengths. When the path difference is an odd number of wavelengths, the two signals (direct and reflected) will arrive at the receiving antenna in-phase. This is especially true when the wave is reflected at small angles of incidence, which cause a phase reversal of 180°. In the case of horizontal polarization, the phase reversal is nearly 180° regardless of the magnitude of the grazing angle. This is also true for almost all instances of vertical polarization in most point-to-point communications systems.

An interesting fact about microwave energy is that the signal tends to be slightly curved. This is because the signals travel through the atmosphere at speeds that depend on temperature, atmospheric pressure, and the amount of water vapor present in the atmosphere.

The following three conditions will have an effect on the microwave signal: The *higher* the temperature, the *faster* the signal; the *lower* the atmospheric pressure, the *faster* the signal; and the *lower* the water vapor content, the *faster* the signal.

With these influences, the net result is that the signal speed changes with altitude. Under normal conditions, the variation is a small and uniform increase in speed of the signal with an increase in altitude. In this manner, it readily can be seen that in a way, the microwave signal acts very much like a light beam. Just as a light beam can be reflected or bent, so can a microwave signal be reflected or bent.

Using the above information, we also can see that microwaves can be very reliable for communications systems. The most important factor is to ensure as direct a line-of-sight path from the transmitter antenna to the receive antenna as possible. With prior study of the potential path, it is really not too difficult to plan a microwave system. The thing to keep in mind is that the complete path of the microwave signal must be free of any obstructions such as trees, hills, or tall buildings. When transmitting over water, the reflected wave may play an important role in the received signal. When you are designing over-water point-to-point systems, it is very important to ensure that this reflected signal does not arrive at the receive antenna in an out-of-phase or nearly out-of-phase state.

A simple rule-of-thumb method can be used to determine possible antenna heights, especially for over water paths. The antenna heights chosen must satisfy the following relation: $\sqrt{2H_1}+\sqrt{2H_2}=S$, where H_1 and H_2 represent the antenna heights in feet above sea level and S represents the distance in miles between the antennas.

The next step is to calculate a correction height using the formula $H=\sqrt{S/F}$, where H is in feet, S is the distance between the antennas in miles, and F is the operating frequency in MHz. The required antenna height for each antenna is the sum of the tentative height and the correction height for each antenna, or, more simply stated, $H_1 + H$ and $H_2 + H$. If the values obtained are not convenient, then select new tentative antenna heights and perform a new calculation.

For example, if we assume a transmitting antenna height of 1400 feet and a receiving antenna height of 2000 feet at a distance of 100 miles, the computation would be: $\sqrt{2(1400)} + \sqrt{2(2000)} = 100$ (miles). The square root of the H_1 component is 52.92; the H_2 square root component is 63.25. This gives us a total of 116.17 miles. It is then quite evident that one or both of the contemplated antennas are too high. By using the S value of 100 and working backwards with the formula, using H_1 as the base antenna and recomputing for H_2 height: 100 − 52.92 = 47.08 squared = 2216.53 divided by 2 = 1108.26 feet. Therefore, the

See List of Advertisers on page 114

new height that meets the relation is 1108 feet for H_2. By the same token, we could have kept antenna H_2 at the height desired and recomputed the height for H_1.

Using the corrected figures for antenna heights of 1400 feet for H_1 and 1108 feet for H_2, we now can compute the correction heights for both antennas at a frequency of 1296 MHz: $H = 660\sqrt{100/1296} = 183.33333$ feet. This gives us a final figure of antenna height for H_1 of 1400 + 183.33 or a total of 1583.33 feet and for H_2 1108 + 183.33 or a total of 1291.33 feet. Given the figures above, we can now look for possible sites to install antennas.

Of course, we may not always find the ideal spots for our antenna construction. In this case, we go back and recalculate using different antenna heights (plus elevation above sea level) to obtain a relative figure equal to the desired distance figure. Sometimes just one or two feet may make the difference at the receive end.

In any attempt at microwave, if at first you do not succeed, try again at another location or change the height of one or both of the antennas. In selecting a good antenna site, a very good aid to locate the ideal sites is a topographical map of the area locality of choice. A source of information for obtaining topographical maps is at your state capital. Try writing a letter either to the State Department of Natural Resources or the State Forestry Division. There is a fee required for copies of these maps, but it is usually very small when one considers the information that can be obtained and the time that can be saved. Happy hamming on the microwave bands. ■

SATURN V
STATE-OF-THE-ART

Quantity discount price structures available upon request for dealers. Dealerships, both domestic and foreign available in many areas. For further information, please contact John Michaels, Sales Manager. Telephone hours: Monday thru Thursday, 10-4.

hi·gain
ELECTRONICS
4558 Auburn Blvd., Sacramento, CA 95841
(916) 452-0193 ✓72

HAM HELP

I am in need of the schematic and alignment information for a Gonset G-77 transmitter and information on a TU-8-B plug-in unit used with BC191/375 transmitters. I will copy and return your originals.

Howard Palmer W6IRT
1125 Basswood Lane
St. Louis MO 63132

I am looking for employment in the electronics field, in the Knoxville-Chattanooga, Tennessee area. My background includes 25 years of experience with rf circuits, and 1st phone license with radar endorsement, and an Extra amateur license.

Herman F. Schnur
115 Intercept Ave.
N. Charleston SC 29405

I am giving away, free, in exchange for postage, a R336/GRC26 army receiver and 6K7, 6J5, 6R7, and 6C5 tubes.

I am looking for an Ameco R5 receiver and schematic for same. Please state condition and price.

Kevin Neal
Route A, Box 211A
Flippin AR 72634

Satellite TV
FOR THE HOME

Sick of Network TV?
Our receiver lets you get over 75 channels of television directly from earth-orbiting cable TV satellites!: HBO, Showtime, super stations, sports and movies worldwide.

We don't just sell information! We Manufacture Hardware!

From offshore oil rigs, data links to hotels and backyard installations, we wrote the book. Constantly updated, our 94 Page technical information book and catalog gives you all the facts. Inexpensive dishes, feeds, telemetry software, kits and more. Recommended reading by NASA, The Office of Consumer Affairs and quality companies like Rockwell/Collins. Send $7.95 today!

CALL ✓309
24-hrs. C.O.D. Hotline
(305) 339-7600
SPACECOAST
RESEARCH CORPORATION
P.O. Box 442-D, Altamonte Spgs, FL 32701

HEATHKIT
SB-104A OWNERS!
Improve BOTH RX and TX Performance Greatly! See Article in April 1981 Ham Radio Magazine.
ALL parts now available from a SINGLE Source. Buy the Kits you need. Complete Instructions.
FTH-1: RX Sensitivity Improvement..... $13
FTH-2: RX Mixer Improvement..... $15
FTH-3: Selectivity Improvement*..... $60
FTH-4: Strong Signal Handling..... $10
FTH-5: TX Switching & Audio..... $5
FTH-A: All above, with Coax..... Only $100
*Includes excellent 8-pole Fox-Tango Filter
Order with Confidence — Money Back Guarantee
We accept Visa/MasterCard
For Airmail to US/Canada add $2, Elsewhere $5
FREE! Complete Instructions. Send Large SASE (or $1)
FOX TANGO CORP.
Box 15944S, West Palm Beach, FL 33406
Phone: (305) 683-9587 ✓323

PRESERVE
73 MAGAZINE
peterborough nh 03458
Keep your issues of 73 Magazine together, handy and protected in handsome and durable library files or binders. Both styles bound in red leatherette with the magazine logo stamped in gold.
Files: Each file holds 12 issues, spines visible for easy reference, $5.95 each, 3 for $17.00, 6 for $30.00
Binders: Each binder holds 12 issues and opens flat for easy reading. $7.50 each, 3 for $21.75, 6 for $42.00
(Postage paid in USA. Foreign orders include $2.50 per item)
Please state years: 1977 to 1983
Send check or money order to:
JESSE JONES BOX CORP.
P.O. Box 5120
Philadelphia, PA 19141
Allow 4 to 6 weeks for delivery

Enjoy Satellite TV Now

Better than Cable TV—Over 200 TV and radio services. Why waste money? Learn the whole story and build a video system the family can enjoy. No commercials. **FREE** movies, sports and Vegas shows—worldwide, crystal clear reception connects to any TV set. Big (8×11 in.) book loaded with details, photos, plans, kits—**TELLS EVERYTHING! Satisfaction Guaranteed.**

Send $7.95 TODAY! Add $2.00 for 1st class (air mail) or call our 24 hour C.O.D. rush order line **(305) 862-5068.**

GLOBAL ELECTRONICS,
P.O. Box 219-H, Maitland, Florida 32751

LIVE VIA SATELLITE

$399 COMPLETE RECEIVING SYSTEM

- **DISH ANTENNA** MOD #7525
- **PREAMPLIFIER** MOD #7202
- **RECEIVER** MOD #7001 MOT

UNDER $300
DISH TYPE ANTENNA FOR ROOF OR PORCH

JUST PUBLISHED: 8½ X 11 BOOK gives a wealth of updated information on • Antennas • Receivers • Low Noise Amplifiers • Sources • Services • Equipment • Manufacturers • Much More.

Our book takes the mystery out of the sophisticated technology of satellite transmission and reception. This volume represents all the essential knowledge **made easy to understand**, and will show you how easy it is to have a 90 channel reception system so that you can enjoy: first run movies, foreign films, Las Vegas entertainment, live sports, and much more. Everything being telecast in the world could be yours at a twist of a knob!

LIVE VIA SATELLITE, INC.
P.O. Box 2561, Dept. M-2, Delray Beach, FL 33444

Send $9.95 plus $2.50 shipping & handling
or call our 24 hr. C.O.D. order line (305) 845-4447

Name _____

Address _____

MICROWAVE ANTENNAS

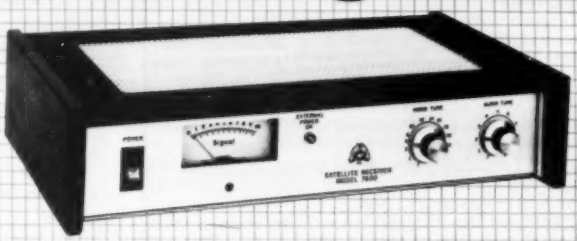
PARABOLIC ANTENNAS FOR SATELITE RECEPTION, POINT TO POINT, OR MICROWAVE A.T.V. WORK

11 FOOT DISH with tripod mount for feed point	$830.00
POLAR MOUNT for satelite t.v.	$690.00
MOTORIZED POLAR MOUNT with control unit	$1284.00
MOTORIZED AZIMUTH - ELEVATION MOUNT	$1968.00
6 FOOT DISH	$360.00
FIXED TOWER MOUNT	$150.00
TOWER TOP AZ-EL MOUNT	$420.00
4 FOOT DISH uses same mounts as 6 foot dish	$224.00
TRIPOD MOUNT for rooftop mounting of dish	$170.00
24 INCH DISH mounts to camera tripod	$60.00

ALL REFLECTORS MADE OF METAL IMPREGNATED FIBERGLASS, ALL HARDWARE TREATED FOR CORROSION RESISTANCE.
FEEDPOINT FOR MOST FREQUENCIES AVAILABLE ON REQUEST.
SHIPPING BY UPS OR MOTOR FREIGHT ALLOW 6 WEEKS FOR DELIVERY
CALL FOR MORE INFO (208) 922 - 4061, 9 am to 9pm mountain time.
PRICES SUBJECT TO CHANGE DUE TO MATERIAL COSTS. ✓327

NORDLUND & ASSOCIATES
780 MENDI PLACE, KUNA IDAHO 83634 JOHN F. NORDLUND KA7HAF

The Vanguard



Introducing the Model 7600 Satellite Receiver. New from Gillaspie and Associates. Proof positive of a new generation in satellite receiver technology: the successful integration of the most sought after high performance characteristics and ease of operation capabilities. Attractively packaged. Affordably priced.

See it today and experience the difference performance makes.

- FULL FREQUENCY tunable audio
- Reception 3700 to 4200 MHz
- Built-in video modulator
- Simplified channel tuning
- Improved video sensitivity
- All wood walnut cabinet

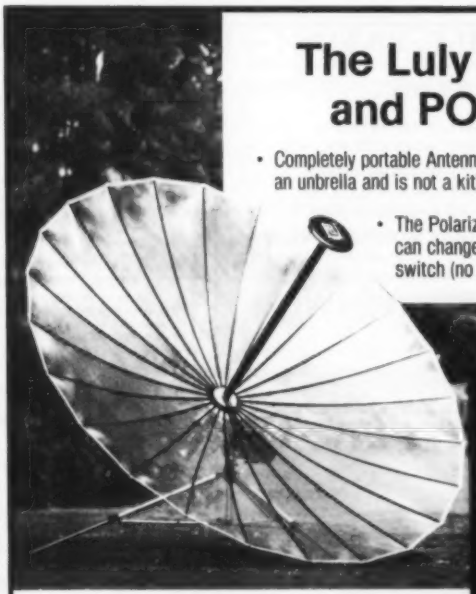
The Model 7600 Satellite Receiver System Package comes with its antenna mounted Image Reject Mixer (Down Convertor), 100' of RG59-U cable and 100' of Belden DC cable with connectors installed.

Gillaspie & Associates

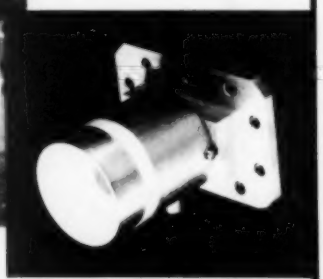
950 Benicia Ave., Sunnyvale, CA 94086 (408) 730-2500 ✓37

GET THE LAST WORD FIRST!
SEE YOUR GILLASPIE & ASSOCIATES DEALER TODAY!

The Luly ANTENNA and POLARIZER



- Completely portable Antenna, comes fully assembled (folds like an unbrella and is not a kit).
- The Polarizer is an electronic rotator, which can change polarities with a flick of a switch (no moving parts). Eliminates weight, twisting cables, freeze ups, and down time.



For More Information Write To:

✓53

LULY TELECOMMUNICATIONS CORP.
P.O. Box 2311, San Bernardino, California 92406
(714) 888-7525
Dealer and Distributor Inquiries Welcome

✓See List of Advertisers on page 114

SATELLITE TV SYSTEMS

"COMPARE OUR QUALITY, PRICES AND SERVICE!"

WE MANUFACTURE:

PARABOLIC DISHES	MOTORIZATION SYSTEMS
POLAR MOUNTS	LNA HOLDERS
DEMO TRAILERS	ALUMINUM HORNS

WE STOCK

WASHBURN	ALLIANCE
KLM	ATV
AVANTEK	CABLE & CONNECTORS
GARDINER	SWITCHES & HARDWARE

CALL, WRITE OR ✓ FOR OUR LATEST BROCHURE AND PRICES.

AUSTIN C. LEWIS
K4GGC
901-784-2191

LEWIS CONSTRUCTION CO. ✓457
P.O. BOX 100
HUMBOLDT, TN. 38343

"IN BUSINESS AT THIS LOCATION SINCE 1964"

NEW! AVAILABLE NOW

AZDEN PCS-300

TWO-METER HANDHELD

PCS-300 HT	$290.00
PCS-3000 XCVR	290.00
Remote cable	37.00
Phase II ant.	28.50
Other acc.	Call

KDK

also: 2025A Mk II (W/TT mic.) $290.00

Free shipping in U.S.A. for all XCVR or HT orders

B. G. CARL ELECTRONICS
11128 Claire Ave.
Northridge, Calif. 91326 ✓469
Call: (213) 363-1216 - anytime

ALL NEW
15 Meter Mobile CW & USB

21.000—21.450 MHz

High 10W (PEP) low 2W (PEP); VFO tuning; noise blanker; fine-tune SB, KHz ± CW off-set; digital frequency counter; 13.8V dc @ 3A, negative ground; L 9.5" x W 9" x H 2.5"; weight (2.3 kg) 5.7 lbs.; mobile mounting bracket.

SERIOUS DEALER LISTS AVAILABLE

N.C.G. CO. NCG ✓318

1275 N. GROVE ST.
ANAHEIM, CALIF. 92806 (714) 630-4541

NOTE: Price, specifications subject to change without notice and obligation.

WORK THE U.H.F. BANDS

Add a transverter or converter to your existing 10m, 6m or 2m equipments. Choose from the largest selection of modules available for DX, OSCAR, EME, ATV.

TRANSVERTERS

MMT 50-144 $234.95
MMT 144-28 $219.95
MMT 432-28 (S) $319.95
MMT 439-ATV $379.95
MMT 1296-144 $399.95
OTHER MODELS AVAILABLE

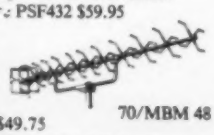
CONVERTERS

Choose from many models to suit your needs.
Examples: MMC 432-28, MMC 426/439—ATV
MMK 1296-144, MMC 1280—ATV
Write for details and available options.

FILTERS

Prevent OSCAR 8 Mode J desense
Use MMF200-7 $42.95
Stop receiver IMD birdies
Use PSF432 $59.95

ANTENNAS



420-450 MHz J-beams
48 el. 15.7 dBd $75.75
88 el. 18.5 dBd $105.50
1250-1300 MHz loop yagi 1296-LY $49.75
70/MBM 48
Send 36¢ stamps for full details of all our VHF/UHF items.

Pre-selector filters
Low-pass filters
Varactor triplers
Pre-amplifiers

Transverters
Converters
Antennas
Crystal Filters

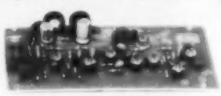
VISA master charge

Spectrum International, Inc.
Post Office Box 1084S
Concord, Mass. 01742 USA ✓436

FAST SCAN *$249

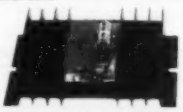
A modular approach... for your own custom-designed ATV system.... Here's how

TXA5-4 ATV EXCITER/MODULATOR.$89 ppd



This wired and tested module is designed to drive the Motorola MHW-710 module in the PA5 10 watt linear amp. The crystal in the 100 mHz region keeps harmonics out of two meters for talk back. The video modulator is full 8 mHz for computer graphics and color. Requires 13.8 vdc reg @ 70 ma. Tuned with xtal on 439.25, 434.0, or 426.25 mHz. Provision for sync expanding. Freq. available.

PA5 10 WATT ATV POWER MODULE $89 ppd

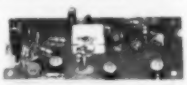


The PA5 will put out 10 watts RMS power on the sync tips when driven with 80 mw by the TXA5 exciter. 50 ohms in and out, plus bandwidth for the whole band with good linearity for color and sound. Requires 13.8 vdc regulated @ 3 amps.

FMA5 AUDIO SUBCARRIER GENERATOR ..... $29 ppd

Puts audio on with your camera video just as broadcast TV does at 4.5 mHz. Puts out up to 1 v p-p to drive the TXA5 or VM-2, 3, or 4 modulators. Requires low Z mic (150 to 600 ohms), and + 12 to 18 vdc @ 25 ma. Works with any xmtr with 5 mHz video bandwidth.

TVC-2 ATV DOWNCONVERTER.... $55 ppd



Stripline MRF901 (1.7 db NF) preamp and double balanced mixer module digs out the weak ones but resists intermods and overload. Connects between uhf antenna and TV set tuned to channel 2 or 3. Varicap tunes 420 to 450 mHz. Requires + 12 to 18 vdc @ 20 ma. Super sensitive TVC-2L with NE64535 preamp (.9db NF) stage....$69 ppd.

***TXA5, PA5, FMA5 and TVC Basic Module Pkg.**

Call or write for our complete list of specifications, station set-up diagrams, and optional accessories which include antennas, modulators, detectors, test generators, cameras, etc. **WE ARE A FULL-LINE SUPPLIER OF ALL YOUR ATV NEEDS.**

TERMS: VISA or MASTER CARD by telephone or mail, or check or money order by mail. All prices are delivered in USA. Allow three weeks after order for delivery.

(213) 447-4565 Charge card orders only

P.C. ELECTRONICS 2522 Paxson Lane,
Tom W6ORG Maryann WB6YSS Arcadia, California 91006

Two Keys To Perfect Code...

The CODEM: a universal CW interface for your personal computer.

$124.95

Here is an easy way to get your Morse code software on the air! The CODEM converts received CW audio to RS232 or TTL signal levels and RS232 or TTL signal levels to transmitter keying. The CODEM doubles as a code practice oscillator and CW regenerator. A sharp 800 Hz bandpass filter, AM detector and low pass filter are designed into the CODEM to provide outstanding noise and QRM rejection. Requires a 9 VDC power supply.

CODEM	**$124.95**
9 VDC Power Supply	**9.95**
Shipping and Handling	**5.00**

CW89: a sophisticated split screen Morse code transceiver and trainer program for Heath computers.

$99.95

Transmit and decode CW with your H-8/H-19, H-89 or Z-89. This feature packed program incorporates 4-99 WPM operation, receive autotrack, a 1000 character pre-type buffer, 10 user-definable messages, unique break-in mode, on-screen status, disk I/O and hard copy and a versatile code practice section. A comprehensive manual and prompt card are included with CW89. Requires HDOS, 32K RAM and hardware interface (such as the CODEM).

CW89 *postpaid*	**$99.95**
CW89C H-8/H-89 Interconnect Cable for CODEM	**24.95**

Save over $14.00 with complete CW package for H-8/H-89.
Package includes CODEM, Interconnect Cable, Power Supply, CW89 Software, complete documentation and shipping.
CW89P **$249.95**

COMMSOFT ↙59
665 Maybell Avenue • Palo Alto, CA 94306 • (415) 493-2184
Write for free catalog
California residents add applicable sales tax. Master Card and VISA accepted

PLESSEY - AVANTEK - PLESSEY

PLESSEY INTEGRATED CIRCUITS

SL1610 RF Amplifier	3.05	SL1623 AM Det/AGC Amp	6.11	SL1640 Double Bal Mod	4.07	SL6690 L.P. IF	5.93
SL1611 RF Amplifier	3.05	SL1624 Multimode Det	6.17	SL1641 Receiver Mixer	4.07	SL6700 L.P.AM IF	5.43
SL1612 AF Amplifier	3.05	SL1625 AM Det/AGC Amp	4.07	SL1680 Xtal Maint Ckt	5.45	SP8660 200 MHz	5.22
SL1613 Limiting Amp	4.38	SL1626 VOCAD/Sidetone	3.72	SL6600 IF Amp/Det	6.78	SP8665 1.0 GHz	54.24
SL1621 AGC Gen	4.07	SL1630 AF Amp	4.14	SL6640 FM Rcvr W/Amp	4.41	SP8680 600 MHz	17.30
SL1622 AF AmpVOG	3.72	SL1631 AF Amp	4.07	SL6650 FM Rcvr W/O A	3.39		

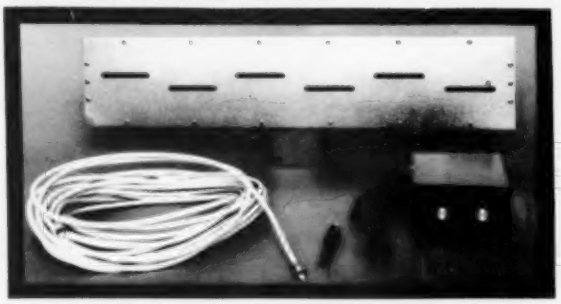
AVANTEK GPD SERIES AMPLIFIERS (GPD 401,402,403) $25.00 EA.

12 - 14 dB Gain 5-500 MHZ.
CIRCUIT BOARDS FOR GPD 400 SERIES AMPS $2.00 ea.

AMATEUR MICROWAVE DOWNCONVERTER

COMPLETE - ASSEMBLED - READY TO INSTALL - NOT A KIT

50+ dB SYSTEM GAIN
TUNES 2.1 Ghz. to 2.4 Ghz.
PREAMPLIFIER 20+ dB GAIN @2.5 dB NF
OUTPUT TUNES TV CHANNELS 2 TO 6
OUTPUT IMPEDANCE 75 OR 300 OHMS
FULL YEAR WARRANTY
PERFORMANCE GUARANTEED OR
YOUR MONEY REFUNDED



SPECIAL $179.95

INCLUDING SHIPPING (U.P.S.)

VISA AND MASTERCARD ACCEPTED
WE STOCK WHAT WE ADVERTISE

CALL (804) 489-2156

ELECTRONIC HOBBY INNOVATIONS ↙447

7510 GRANBY STREET SUITE 207 NORFOLK, VIRGINIA 23505

↙See List of Advertisers on page 114

"I see Instant Software in your future..."

"....It's becoming very clear now... Your microcomputing life is going to be very exciting...Money! I see much money for you. Perhaps it is the money you will gain when Instant Software's new business applications guide your financial endeavors. I see travel...you will journey to distant worlds in distant times. You will build kingdoms from deserts and armies from slaves. Never will you be bored, adventurous one! Your programming burdens will lighten with new utilities—new tools. I see color! Many bright colors! I see new packaging for all these treasures...everything new! And...yes, a tall, handsome stranger who will guide you to these wonders. It will be your Instant Software dealer—a wise one indeed. All awaits you—all is yours for the asking. Soon...very soon!"

THIS MANY DEALERS CAN'T BE WRONG.

ALABAMA
THE COMPUTER SHOP, Gadsden
DILENSKY BROS., Mobile
ALASKA
COMPUTER TALK, Anchorage
ARIZONA
CEMF, Phoenix
COMPUTER STORE, Phoenix
MESA ELECTRONICS, Mesa
MILLET'S ELECTRONICS, Mesa
PERSONAL COMPUTER PLACE, Mesa
SIMUTEK, Tucson
TOY BOX, Sierra Vista
ARKANSAS
MICRO COMPUTER SYSTEMS, Hot Springs
CALIFORNIA
ADVANCE RADIO (R/S DEALER), Grass Valley
ADVANCED COMPUTER PRODUCTS, Santa Ana
ALBANY TYPEWRITER, Albany
ALLTRONICS, San Jose
AMCO ELECTRONIC SUPPLY, Azusa
ASAP COMPUTERS, Signal Hill
BYTE INDUSTRIES, Hayward
BYTE SHOP, Mountain View
CAPITOL COMPUTER SYSTEMS, Sacramento
CHADCO COMPUTERS, El Monte
COAST ELECTRONICS, Morro Bay
COMPUSOUND, Orange
COMPUSUP, Lancaster
COMPUTER MART OF CALIFORNIA, INC., Diamond Bar
COMPUTERLAND, San Francisco
COMPUTER PLUS, Sunnyvale
COMPUTER STORE, San Leandro
COMPUTER WORLD, Westminster
DEROSEAR APPLIANCE & REPAIR, Weaverville
DIMENSIONAL SOFTWARE, San Diego
H. W. ELECTRIC, Northridge
EXATRON, Santa Clara
GAME-O-RAMA, Santa Barbara
GOOD FAIRE NATURAL FOODS, Lompoc
HOBBY WORLD ELECTRONICS, Northridge
HUNTINGTON COMPUTING, Corcoran
INLAND ELECTRONICS, Riverside
MALIBU MICROCOMPUTING, Malibu
MARFAX CO., San Jose
MICROCOMPUTING, Corcoran
NET PROFIT COMPUTERS, Torrance
OPAMP/TECHNICAL BOOKS, Los Angeles
OPPORTUNITIES FOR LEARNING, Chatsworth
PC COMPUTERS, El Cerrito
Q I COMPUTERS, INC., Lawndale
RAC PRODUCTS, San Jose
RADIO SHACK, El Cajon
RADIO SHACK, Palm Springs
RADIO SHACK, San Diego
REV SOUND (R/S DEALER), Fortuna
SALINAS HOBBY CENTER, Salinas
SHAVER RADIO, San Jose
SILVER SPUR ELECTRONICS, Chino
SOFTWARE PLUS, El Toro

STACEY'S BOOKSTORE, San Francisco
STRAWFLOWER ELECTRONICS (R/S DEALER), Half Moon Bay
THE COMPUTER STORE, Santa Monica
THE FEDERATED GROUP, Commerce
THE SOFTWARE STORE, Huntington Beach
THE SOFTWARE STORE, Los Angeles
WABASH APPLE, El Toro
WEHNER BUSINESS SYSTEMS, Los Altos
COLORADO
APPAPAT, Denver
FISTEL'S MICRO ELECTRONICS, Denver
POOR RICHARD'S CALCULATORS, Fort Collins
CONNECTICUT
BYTE ME COMPUTER SHOP, New London
COMPUTER LAB, New London
INSTRUCTIONAL SYSTEMS COMPUTERS, Manchester
TECHNOLOGY SYSTEMS, Bethel
THE COMPUTER STORE, Stamford
DELAWARE
MICRO PRODUCTS, Wilmington
DISTRICT OF COLUMBIA
THE PROGRAM STORE, Washington, D.C.
FLORIDA
ALL SYSTEMS GO, Winter Garden
AMF MICROCOMPUTER CENTER, Tampa
COMPUTER CENTER, West Palm
COMPUTER HAVEN, Melbourne
COMPUTER JUNCTION, Fort Lauderdale
COMPUTER SYSTEM RESOURCES, Gainesville
COMPUTER WORLD, Clearwater
COMPUTERLAND, Jacksonville
COMPUTERLAND, Sarasota
COMPUTERLAND, Tampa
COMPUTERLAND, West Palm Beach
CREATIVE COMPUTING, Orlando
DATA UNLIMITED, Melbourne
H&H HOBBY SALES, Sarasota
HEATHKIT ELECTRONIC CENTER, Hialeah
HIS COMPUTERNATION, Melbourne
KOBY'S KORNER, Pensacola
MICROCOMP LTD., Miami
MICROCOMPUTER SYSTEMS INC., Tampa
MINI CONCEPTS, Holly Hill
MICRO DATA BASE, Lakeland
RAY'S AMATEUR RADIO, Clearwater
RICK'S TV, Ocala
SOUND IDEAS, Gainesville
SOUTH EAST MICRO DATA, Orlando

GEORGIA
ATLANTA COMPUTER MART, Atlanta
BAILEY'S COMPUTER SHOP, Augusta
DELTA DATA DYNAMICS, Tucker
ENERGY LOGIC, Columbus
FLEMING DRUG CO., Vienna
HAWAII
HONOLULU ELECTRONICS, Honolulu
MILLS ELECTRONICS, Lahaina
RADIO SHACK ASSOC. STORE, Honolulu
IDAHO
CDR & NELSON, Moscow
DENNIS STONE ENTERPRISES, Fruitland
ELECTRONIC SPECIALTIES, Boise
IDAHO MICROCOMPUTER, Buhl
R&L DATA SYSTEMS, Idaho Falls
ILLINOIS
ALPINE COMPUTER CENTER, Rockford
CHICAGO MAIN NEWSTAND, Evanston
COMPREHENSIVE MICRO SYSTEMS, Chicago
COMPUTER JUNCTION, Elmhurst
COMPUTER STORE, Rockford
COMPUTERLAND, Niles
CREATIVE PROGRAMMING, Charleston
GARCIA & ASSOCIATES, Chicago
ILLINOIS CUSTOM COMPUTERS, Harrisburg
JNL COMPUTER SYSTEMS, Downers Grove
MIDWEST MICRO COMPUTERS, Lombard
THE PILOT HOUSE, Gladstone
WALLACE COMPUTERS, Peoria
INDIANA
ABC HOBBY, Evansville
D&D ELECTRONICS, Angola
DIGITAL TECHNOLOGY, Lafayette
FALL CREEK ELECTRONICS, Pendleton
GAME HUT, Bloomington
GAME PRESERVE, Indianapolis
PROFESSIONAL MICROCOMPUTER SOFTWARE, Muncie
SIMONTON LAKE DRUGS, Elkhart
THE BOARDROOM, Indianapolis
THE HAM SHACK, Evansville
IOWA
BEACON ELECTRONICS, Ames
LENWOOD SYSTEMS, Center Point
MEMORY BANK, INC., Bettendorf
SERNETT LEISURE CENTER, Carroll
KANSAS
AMATEUR RADIO EQUIPMENT, Wichita
CENTRAL KANSAS COMPUTERS, Hennigton
COMMUNICATIONS CENTER, Lincoln
GOSLIS INTL, Wichita
HATCH COMPUTER CENTER, Altoona
HIGH TECHNOLOGY, Wichita
KENTUCKY
CBM, INC., Lexington
COMPUTER MAGIC, Louisville
PERRY'S COMPUTER, Bremen
LOUISIANA
ACME BOOK CO., Baton Rouge
COMPUTER SERVICES OF SHREVEPORT, Shreveport
COMPUTER SHOPPE, Metairie
MAINE
FRYEBURG COMPUTER CENTER, Fryeburg
MAINE COMPUTRONICS, Bangor
MAINE MICRO SYSTEMS INC., Auburn
MID-MAINE COMPUTER COMPANY, Auburn
MARYLAND
COMM CENTER, Laurel
PROGRAM STORE, Baltimore
SOFTWARE ETC., Frederick
WILLS COMPUTER STORE, Marlow Heights
MASSACHUSETTS
LAND OF ELECTRONICS, Lynn
MARK GORDON COMPUTERS, Cambridge
MIDDLEBORO MUSIC (R/S DEALER), Middleboro
MICROCON, Watertown
OMNITEK SYSTEMS, Tewksbury
SOUND COMPANY, Springfield
STAR COMPUTING, Framingham
THE GAME SHOP, East Acton
MICHIGAN
ALL FOR LEARNING, W. Bloomfield
ALTERNATE SOURCE, Lansing
A.M. ELECTRONICS, Ann Arbor
COMIC KINGDOM, Detroit
COMPUTER CENTER, Garden City
COMPUTER CONNECTION, Farmington Hills
COMPUTER MART, Dearborn
COMPUTER MART, Flint
COMPUTERLAND, Kentwood
COMPUTERLAND, Southfield
COMPUTRONICS, Midland
EIGHT BIT CORNER, Muskegon
FERRIS RADIO, Hazel Park
GOLDEN ARROW, South Haven
HOBBY HOUSE, Battle Creek
LEARNING CENTER LTD., Ann Arbor
MAIN SYSTEMS, INC., Flint
MID-MICHIGAN MICRONET, Dimondale
NEWMAN COMMUNICATIONS, Grand Rapids
NEWMAN COMPUTER EXCHANGE, Ann Arbor
TRI-COUNTY ELECTRONICS & SOUND CENTER, Fenton
WEATHERWAX DRUGS, Brooklyn
WIZARD'S ARSENAL, East Lansing
YE OLDE TEACHERS SHOPPE, Ypsilanti
MINNESOTA
ODDE ROOM, Eden Prairie
LANTOS COMPUTER CORP, Minneapolis
MINNESOTA SOFTWARE, White Bear Lake
RURAL AMERICA ENTERPRISES, Marshall
ZIM COMPUTERS, Brooklyn Center
MISSISSIPPI
C-COM, Jackson
DYER'S INC., West Point
SOFTWAREHOUSE, Jackson
MISSOURI
CENTURY NEXT COMPUTERS, Columbia
COMPUTER CENTER, Joplin
COMP-U-TRS, Florissant
CRC COMPUTERS, Joplin
D'S, Cameron
HOUSE OF COMPUTERS, Joplin
MOORE SOFTWARE, Parkville
SOFTWARE SHACK, Belton
MONTANA
COMPUTER STORE, Billings
THE COMPUTER PLACE, Kalispell
NEBRASKA
APPLETREE SOFTWARE, Battle Creek
COMPUTERS WEST, Omaha
GREAT RACE HOBBY PLACE, Lincoln
HATCH COMPUTER, Alliance
LEZOTTE STUDIO, Ogallala
MICROAGE COMPUTER STORE, Omaha
NEVADA
HURLEY ELECTRONICS, Las Vegas
NEW HAMPSHIRE
BITS'N'BYTES COMPUTER CENTER, Concord
COMPUCRAFT, Keene
COVER CRAFT, Amherst
PAUL'S TV, Fremont
PORTSMOUTH COMPUTER CENTER, Portsmouth
RADIO SHACK ASSOC. STORE, Keene
RADIO SHACK, Claremont
RIDER RADIO (R/S DEALER), Peterborough
STUROVANT AND DUNN, Conway
NEW JERSEY
ABE'S TV SALES & SERVICE, Glassboro
ADELMAN'S STATIONERY CO., Union City
BARGAIN BROTHERS, West Trenton
CHANNEL 1 RADIO SHACK, Medford
COMPUTER FORUM, Redbank
COMPUTER MADNESS, Englishtown
COMPUTERMANIA, Princeton
COMPUTERWORLD OF WESTFIELD, Westfield
CROWLEY'S, Whitehouse Station
DAVE'S ELECTRONICS, Inc., Pennsville
ELECTRONIC WORLD, Mantua
HOBBYMASTERS, Red Bank
J&J ELECTRONIC WORLD, Mantua
LASHEN ELECTRONICS, INC., Denville
MIDAS DATA SYSTEMS INC., Marlton
RADIO SHACK ASSOC. STORE, Moorestown
RADIOS UNLIMITED, Somerset
SOFTWARE CITY, Pine Brook
SOFTWARE CITY, River Edge
NEW MEXICO
AUTEL ELECTRONICS CO., Albuquerque
LEW ENTERPRISES, Clovis
MICROAGE COMPUTER STORE, Albuquerque
MITCHELL MUSIC, Carlsbad
THOMAS E. CARR JEWELER, Alamogordo
WARGAMES WEST, Albuquerque
NEW YORK
ARISTO CRAFT DISTINCTIVE MINIATURES, New York
ASD HOME COMPUTER CENTER, Poughkeepsie
BERLINER COMPUTER CENTER, New Hyde Park
COMPUTER CORNER, White Plains
COMPUTER RESOURCES, Williamsville
COMPUTER SHOP, Binghamton
COMPUTER TREE, Endwell
COMPUTERLAND, Carle Place
COMPUTERLAND OF NYC, New York
DIGIBYTE SYSTEMS, New York
60-MICROCOMPUTER SERVICES, Cohoes
FUTURE VISIONS COMPUTER STORE, Menlvia
MICROHUT, Brooklyn
MODERN TEK SHOPS, Snyder
MR. COMPUTER, Wappingers Falls
PHR CLEAN AIR ENTERPRISES, Plattsburgh
PHANTOS RESEARCH, Camillus
PROGRAMS UNLIMITED, Jericho
SOFTRON SYSTEMS, Rensselaer
WATERLOO HOBBIES, Mineola
WORLD OF COMPUTERS, Port Chester
NORTH CAROLINA
RAYBURN MICRO-ELECTRONICS, Sylva
SOUND MILL, Havelock
OHIO
ABACUS II, Toledo
ALTAIR SYSTEMS, INC., Dayton
ASTRO VIDEO ELECTRONICS, INC., Lancaster
CINCINNATI COMPUTER STORE, Cincinnati
COMPUTER STORE, Toledo
COMPUTERLAND, Cuyahoga
COMPUTERLAND, Mayfield Heights
COMPUTERLAND, North Olmsted
COMPUTERLAND, Warren
JERRY'S COMPUTER, Cleveland
JOBAR ENTERPRISES, Middefield
MICROAGE, Columbus
MICRO COMPUTER CENTER, Centerville
MICRO ELECTRONICS INC., Columbus
MICRO-MINI COMPUTER WORLD, Columbus
TWENTY-FIRST CENTURY SHOP, Cincinnati
WARMA PLAY, Cincinnati
OKLAHOMA
COMPUTER STORE, INC., Tulsa
COMPUTER WORLD, Tulsa
WM. DAVIS D/B/A PROFILE MNGMT, Moore
RADIO SHACK ASSOC. STORE, Guymon
SOUNDS, ETC., Watonga
OREGON
COMPUTER SPECIALTIES, Salem
COMPUTERLAND OF PORTLAND, Tigard
L&R ELECTRONICS, Grant Pass
PIONEER ELECTRONICS, Sandy
PENNSYLVANIA
ALLIED HOBBIES, Philadelphia
ARTCO ELECTRONICS, Kingston
BELL ELECTRONICS, Edinboro
BELL ELECTRONICS, Girard
COMPUTERLAND, Gibsonia
COMPUTERLAND OF HARRISBURG, Mechanicsburg
ERIE COMPUTER, Erie
J&E COMMUNICATIONS, Altoona
MAFER ASSOCIATES, Johnstown
PERSONAL COMPUTER CORP., Plain
PERSONAL SOFTWARE, Newer Ltd., Malvern
PITTSBURG COMPUTER STORE, Pittsburg
STEVENS RADIO SHACK DEALER, Phoenixville
RUMPLESTILSKIN TOY SHOP, New Hope
TELEVISION PARTS COMPANY INC., New Brighton
PUERTO RICO
MICRO COMPUTER STORE, Cappora Terrace
RHODE ISLAND
COLONIAL ENTERPRISES (R/S DEALER), Foster
SOUTH CAROLINA
OMNI ELECTRONICS, Charleston
TENNESSEE
ACE MINI SYSTEMS, Clarksville
CHATTANOOGA COMPUTER CENTER, Chattanooga
COMPUTER WORLD, Nashville
COMPUTERLAB, Memphis
H&H ELECTRONICS, Tullahoma
TEXAS
AUDIO WORKS, Lufkin
CODEDATA INC., Arlington
COMPUTER CONCEPTS, Beaumont
COMPUTER 'N THINGS, Austin
COMPUTER PROGRAMMING ASSOC., Lubbock
COMPUTER PORT, Arlington
COMPUTER SALES & SERVICE, Fort Worth
COMPUTER SOLUTIONS, San Antonio
COMPUTERLAND OF SW HOUSTON, Houston
COMPUTERS BY O'NEILL, Lake Jackson
COMPUTERS TO GO, Austin
COMPUTEX, Webster
CORSAIR, Ft. Worth
GATEWAY ELECTRONICS, Houston
THE HOBBY CENTER, Abilene
KA ELECTRONICS, Dallas
MAC'S TV, Fairfield
MARYMAC INDUSTRIES (R/S DEALER), Houston
MICRO COMPUTER CONCEPTS, Plano
PAN AMERICAN ELECTRONICS (R/S DEALER), Mission
R.L. COLE'S ELECTRONICS, San Antonio
ROY'S CB & ELECTRONICS, Aransas Pass
S-100 SOFTWARE, San Antonio
TOTAL COMPUTER STORE, Beaumont
WAGHALTER BOOKS, INC., Houston
UTAH
COMPUTERLAND, Salt Lake City
FOOTHILL MODELERS, Salt Lake City
QUALITY TECHNOLOGY, Salt Lake City
VERMONT
TEMPO CO. (R/S DEALER), Brattleboro
VIRGINIA
COMPUTER SOLUTIONS, Leesburg
COMPUTER WORKS, INC., Harrisonburg
FRAME GALLERY, Herndon
HOME COMPUTER CENTER INC., Virginia Beach
LITTLE SOLDIER, Alexandria
SYSTEMS MARKETING, Arlington
WASHINGTON
AMERICAN MERCANTILE COMPANY, Seattle
C&J ELECTRONICS, Richland
COMPUTERLAND, Bellevue
COMPUTERLAND, Federal Way
COMPUTERLAND, Spokane
THE ELECTRONIC SHOP, Olympia
EMPIRE ELECTRONICS, Seattle
EMPIRE ELECTRONICS, Sunnyside
J.B. SALES, Snohomish
LORDS, Port Angeles
PERSONAL COMPUTERS, INC., Spokane
UNIVERSITY VILLAGE MUSIC, Seattle
U.S.S. ENTERPRISE, Kirkland
WESTERN MICROCOMPUTER CENTER, Bellingham
WEST VIRGINIA
COMPUTER CORNER, Morgantown
COMPUTER STORE, Huntington
OHIO VALLEY ELECTRONIC SYSTEMS, Wheeling
SOUND & ELECTRONIC SPECIALTIES, Morgantown
UHF SALES, Evans
WISCONSIN
BYTE SHOP, Greenfield
BYTE SHOP, Milwaukee
COMPUTER WORLD, Appleton
COMPUTER WORLD, Green Bay
COMPUTERLAND, Madison
COMPUTERLAND, Milwaukee
COMPUTERLAND, Wausau
COMPUTERLAND OF FOX RIVER VALLEY, Oshkosh
MAGIC LANTERN COMPUTER, Madison
OMEGA MICROS, Milwaukee
PETTED MICROSYSTEMS, Milwaukee
S&O TV SALES, Monroe
WYOMING
COMPUTER CONCEPTS, Cheyenne

AUSTRALIA
CSA MICROCOMPUTING, Sidney
DE FOREST SOFTWARE, Nunawading, Vic.
CANADA

Distributor
MICRON DISTRIBUTING, Toronto, Ont.

ALLIED COMPUTER CENTRE, Thunder Bay, Ontario
ARKON ELECTRONICS, Toronto, Ontario
AULL COMPUTER SYSTEMS, Victoria, B.C.
BITS & BYTES, Dartmouth, N.S.
CENTRAL DISTRIBUTORS LTD., Lachine, Quebec
COMPUCORNER, Smithers, B.C.
COMPUMART, Ottawa, Ontario
COMPUTER BARN, Sarnia, Ontario
COMPUTER CIRCUIT, London, Ontario
COMPUTER INNOVATIONS, Ottawa, Ontario
COMPUTER SHOP LTD., Calgary, Alberta
COMPUTER WORLD, Vancouver, B.C.
COMPUTERLAND OF BURLINGTON, Burlington, Ontario
CREATIVE COMPUTERS, Victoria, B.C.
DATATEC COMPUTER SYSTEMS LTD., Saskatoon, Sask.
ELECTRONICS 3001, Willowdale, Ontario
GALACTICA COMPUTERS LTD., Edmonton, Alberta
IRISCO DU QUEBEC, Ste. Foy, Quebec
LYONS LOGIC LTD., London, Ontario
MICROMATION, Toronto, Ontario
MICROSHACK, Saskatoon, Sask.
MICRO SHACK, Regina, Sask.
M&W COMPUTERS, Mississauga, Ontario
NIP & TUCK VARIETY, London, Ontario
OFFICE CENTRE, Kingston, Ontario
PAULT OFFICE MACHINES, Sault Ste. Marie, Ontario
STATUS COMPUTER SYSTEMS, St. Catherines, Ontario
TOTAL COMPUTER SYSTEMS, Ajax, Ontario
WEST WORLD COMPUTERS, Edmonton, Alberta

ITALY
BITS & BYTES, Milan

FRANCE
ACE Compossanto, Paris

NETHERLANDS & BELGIUM

Distributor
SOFTWARE IMPORT BRABANT, Eindhoven, Neth.

COMPUTER COLLECTIEF, Amsterdam
MICRO COMPUTING, Kromminie
MICRO DYNAMICS, Eindhoven
MUSICRAFT COMP. Leiden
GIVEL GONNE, Drachten
R.A.L. MICROCOMPUTERS, The Hague

NEW ZEALAND
"MICONIC" ELECTRONICS, Palmerston North
NORWAY
AS SORLUND, Vedavagen
SWEDEN
SENTEC AB, Jarfalla
UNITED KINGDOM
CALISTO COMPUTERS, Birmingham
THE SOFTWARE HOUSE, London
WEST GERMANY
MICROSTUFF, Frankfurt

YOUR NAME COULD BE HERE. CALL: 1-800-258-5473

WHAT DO THEY KNOW THAT YOU DON'T?

Find out. Fill out this coupon (or make a photocopy) and mail it today. You'll receive a dealer pack, filled with details on how you can join the ranks of the successful dealers listed above—with Instant Software.

NAME: _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP:** _____

Instant Software™ Inc. ↵445 Peterborough, N.H. 03458 603-924-7296 DC-27

↵See List of Advertisers on page 114

Jerry Dijak W9JD
215 Tareyton Drive
Ithaca NY 14850

CW Interface

—let your computer do the copying

It is one thing to obtain software to decode Morse code with your computer, but it is quite another to process the audio signal delivered by your receiver in such a way that the computer can use it. This article will describe one approach to solving this hardware problem and also describe the construction and operation of an interface circuit using these principles.

I will assume that you already have software for decoding Morse and will describe the needed hardware. An example of such a program was presented by Thomas[1] in the December, 1977, issue of *73*. For our purpose, we will assume that your software requires a TTL signal that is logic low during the key-down intervals and logic high during the key-up intervals.

Proper operation of your decoding algorithm will require the presence of one logic level during the key-down interval and the opposite logic level for the key-up state. The computer must see only one or the other of these states at any one time, and they must change only when the state of the desired signal changes. State changes should not be affected by interfering signals or random noise.

An extremely simple circuit could successfully be used to interface a computer to a ham receiver if the audio signal produced by the receiver were perfect (absolutely noise-free and of constant level and frequency), but the circuit must be considerably more elaborate if the computer is to perform properly with the imperfect signals typical of ham-band operation.

Typical receiver output during CW reception on today's ham bands presents a difficult problem when attempting to decode the signal with a computer. Even if the operator is using a selective receiver (400-Hz bandwidth) designed for CW reception, several different signals usually will be present in the audio. The signal that the operator is trying to copy probably will be tuned for his preferred pitch, while the others will be present at other frequencies. The desired signals probably will be the strongest, but the others may be fairly strong also.

In addition to these interfering Morse signals, there will be noise. In the signal output that is available to the computer interface circuit, we will have, in general, voltage due to our one desired signal and also considerable voltage due to all the other signals and noise being processed by the receiver. In order to decode the desired signal successfully, we must have a way to detect the voltage due to our desired signal while ignoring as best we can the other signals and noise.

Desirable Interface Qualities

We can summarize several design objectives for our receiver-computer interface. First of all, it should be (as always) small, inexpensive, and easy to construct and operate. Second, it should respond only to one very narrow band of audio frequencies, for maximum immunity to adjacent signal interference and noise. Third, the output should be bistable and TTL-compatible for proper interpretation at the computer input port; the output should be either logic high (+3.5 to +5 volts) or low (0 to +0.6 volts) and never in between. Fourth, the decision threshold of the detector should be adjustable to allow the interface to operate properly with both high- and low-level audio so that the operator is not forced to operate a certain audio gain setting which may not always be convenient. And fifth, the interface should work while the speaker of the receiver is operating, so that the operator can hear the code while it is being decoded to allow detection of computer errors (decoding errors can be expected under adverse reception conditions).

Theory

Fig. 1 is a block diagram of one approach to doing the required processing of the receiver audio. The first stage is a limiter which produces a known signal level at the beginning of the circuit; this allows the rest of the device to be designed optimally for this level. The limiter is followed by a 4-pole active bandpass

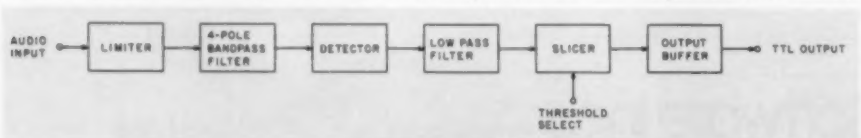


Fig. 1. Interface block diagram.

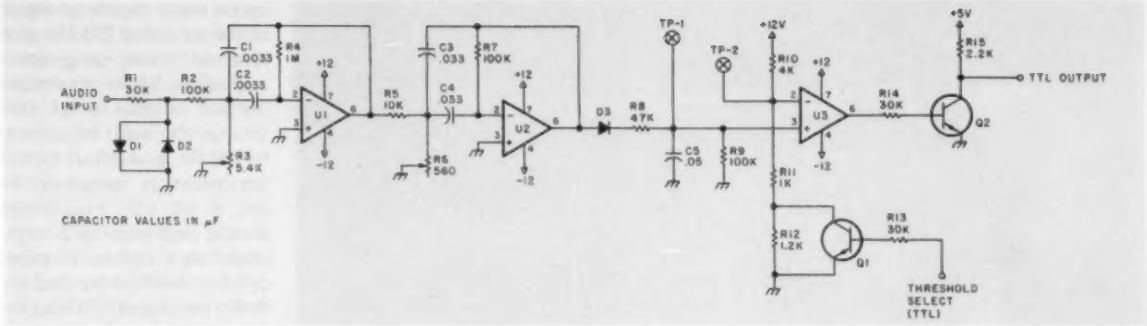


Fig. 2. Interface schematic.

filter. The filter is tuned to 950 Hz and has a design bandwidth of 80 Hz. This filter works by amplifying the signal about 16 times at its center frequency and attenuating signals not within its passband. This ensures that the detector stage only sees voltage due to the desired signal. The detector itself is merely a half-wave rectifier (a diode), and it is followed by a simple RC low-pass filter so that the output of the filter follows the pulse shape of the signal as closely as possible. The output of this stage will be maximum when the signal is present and minimum when there is no signal present.

The slicer stage decides whether there is a signal present or not. It does this by comparing a preset threshold voltage to the voltage it receives from the detector and filter. Whenever the received signal exceeds the preset threshold, the slicer quickly switches its output state from -10 V to +10 V.

Under ideal conditions, the output voltage at this point in the circuit would never exceed this preset threshold when only noise and interfering signals were present. If the voltage exceeds the threshold only when the desired signal is indeed present, no errors will be generated. If this is not the case (and usually it is not), errors will be generated whenever the combined level of the interference and noise exceeds the threshold. (The slicer will change state.) As soon as the voltage subsides, the slicer will revert to the correct state. For optimum operation of the overall hardware/software system, your decoding algorithm should be designed to ignore these spurious but unavoidable brief state changes due to noise.

Finally, the output buffer converts the signal levels produced by the slicer (which are incompatible with the computer input gates) to correct TTL levels.

The Circuit

Fig. 2 shows the schematic of one circuit that meets the design objectives outlined above. I know that not many people build anything exactly as it is described in a magazine article (neither do I), so I will not only describe this circuit but will also give a little of the thought behind the design choices that I made.

Diodes D1 and D2 form the limiter, and these should be silicon types to give a limited signal of about ±0.6-V peak at this point. R1 is used to keep the input impedance of this interface high so that it may be used across an existing high-impedance output of your receiver (the anti-VOX output on a Drake R-4, for instance), in parallel with whatever you normally connect to that output. So, this circuit can simply be added to your existing layout with little effect. Also, because the signal level is limited to 0.6 V, only about a 1-volt peak of audio signal is required at the input to this device. On my receiver, the anti-VOX output puts out more than enough voltage at moderate speaker volume levels. Another advantage of permanently connecting the interface to a high-impedance point in your receiver is that the speaker and headphone outputs can be used or disabled without affecting the connection to the interface.

Components R2 through U2 make up the 4-pole active bandpass filter. My first prototype used only a single-stage filter (2-pole), but I found that it was allowing too much interference from adjacent signals. I therefore decided to go to a 4-pole design, with the resultant much steeper skirts to the passband. The filter design itself was arrived at with the help of articles by Stark[2] and Stewart[3] in past issues of *73*, regarding active filter design. Each stage of the filter is designed for a Q of 10. The center frequency of stage 1 is 975 Hz and that of stage 2 is 930 Hz. This yields a 3-dB passband of about 80 Hz and very steep skirts and requires only 2 ICs. (Strictly following the criteria used by Stark would have yielded filter stages with higher Qs, but also would have required a total of 4 ICs and several more resistors in the design. My approach sacrifices some skirt steepness but eliminates many components. That was my choice.)

Each filter stage is designed for a gain of 4.8 so that at the overall filter center frequency of 950 Hz the complete filter has a gain of about 16. With the 0.6-V peak input, about 10-volts peak output is developed at the detector. If you would like to try your own hand at designing the filters (perhaps you'd like to use capacitors you have in your junk box or a different center frequency), use the procedures given in either of the above two articles but be careful to keep the first resistor (R2) around 100k or greater so that the input is not loaded down. R1 and R2 form a voltage divider, and smaller values of R2 will require more drive voltage from your receiver for full limiting.

Diode D3 is the detector, and R8, C5, and R9 form the simple low-pass filter. The filter components were arrived at by experiment, the goal being use of a physically small capacitor at C5 and optimum following of the keyed signal pulse shape at speeds up to about 30 wpm. These values meet these criteria well.

U3 is the slicer, and the resistor network R10, R11, and R12 with Q1 produce a software-controllable variable threshold. Using the indicated resistor values, when Q1 is not conducting, the threshold at pin 2 of U3 will be about 1.8 volts.

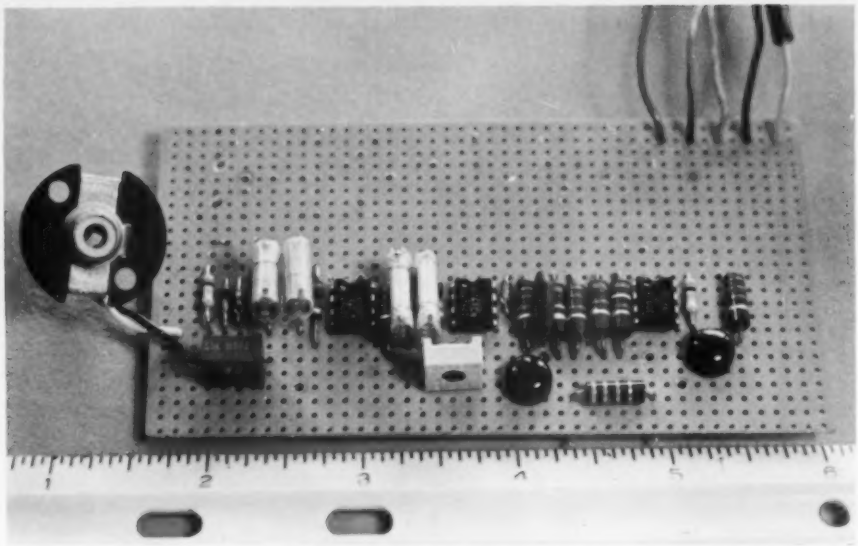


Photo A. Interface prototype.

When Q1 *is* conducting, the threshold will be lowered to about 1.0 volt. Thus, by tying the input to R13 to one bit of an output port, you can control the slicer threshold through software. This could have been done with a mechanical switch, but I wanted to mount this circuit deep within the bowels of my computer, controlled only by my commands via the keyboard. This approach took a while to design, but it requires very little additional space on the circuit board.

Under normal conditions, one would use the higher threshold for the best performance. But when you are operating with a signal level that is not strong enough for full limiting and noise conditions are favorable, you can extend your operating range by lowering the threshold to about 1 volt.

The output of U3 is either about +10 or −10 volts depending upon the detector output to U3. These levels could not be applied safely to the TTL input port of a computer, so the buffer stage, Q2, was added to provide a signal that always remains within the TTL operating range of 0-5 V. The output of Q2 can be tied directly to one bit of an input port.

With this circuit, the idle, or no signal, state of the output is logic high (+5 V). When a signal is present, the output drops to 0 V.

Construction

Photo A shows the prototype of this circuit in final form. My next step will be to reassemble it on a plug-in vectorboard for mounting directly inside my computer. As you can see, it requires a total area of about 2 by 4½ inches on the board. None of the components dissipates an appreciable heat, so it is safe to mount them adjacent to each other (but be careful not to short any leads). The wires visible in the upper-right portion of the board are for my temporary power and computer connections to the circuit.

All resistors used in the circuit need be no larger than ¼ Watt. I used what I had in my junk box, so some of the resistors in the photo are ½ Watt. Capacitors C1 through C4 should be high-quality polystyrene or mylar™ (and not disc ceramic) as pointed out by Stark. Try to get values for R2, R4, R7 as close to those listed as possible—although the final adjustments of R3 and R6 will compensate for any variations from the optimum values. The values for the two trimpots, R3 and R6, need be considered only approximate, and the final adjustment of these two can be expected at about mid-range if the indicated values are used.

Diodes D1 and D2 must be silicon types (small signal) and D3 can be either silicon or germanium. C5 can be disc ceramic. Q1 and Q2 are any general purpose silicon transistors capable of operating with a 2-mA collector current and a beta of at least 100 (type 2N3566 were used here).

As you can see from the photo, it is not necessary to etch a PC board. All three ICs are type 741. Power supply voltages of +12, −12, and +5 volts are required, but these should be available readily in most computers.

Alignment and Check-Out

The only alignment required is that of properly tuning each filter stage. For this, you will need some type of known frequency audio input. Apply an input to the circuit at 975 Hz, at a level of 1 volt or greater, and adjust R3 for maximum output at pin 6 of U1. Change the input frequency to 930 Hz and adjust R6 for maximum as measured at pin 6 of U2. You then should find that the 2-stage filter has a center frequency of about 950 Hz and an 80-Hz passband. With an input signal level sufficient for full limiting, about 10 volts (peak) signal should be available at the output of U2. Under these same conditions, the voltage at TP-1 should be about 3 volts (dc). As a final check, you can confirm that the output of Q2 is +5 V with no signal applied and 0 V when a 950-Hz signal is present.

Operation

Once the above initial alignment is completed, no further adjustments need be made. When operating the interface, all one must do is tune the desired CW signal properly so that it falls within the filter passband and adjust the receiver's audio level to an optimum value. These two tasks, however, are not quite as easy as they sound.

The easiest way to tune your receiver for optimum operation of the interface requires an oscilloscope. While there is another technique, it has some severe limitations. I will first cover tuning with an oscilloscope, and then the alternative if a scope is not available.

Oscilloscope Method

For the moment, let us assume that you have a dual-trace oscilloscope at your disposal for operation of your receiver-computer combination. Connect one channel to TP-1 in the circuit and the other channel to TP-2. Use dc coupling for both. Use a vertical sensitivity of 500 mV per division for both channels and a sweep speed of 10 ms per

division. Adjust the baselines of both traces to exactly the same point near the bottom of the graticule. You should then obtain a display similar to that shown in Photo B when a properly tuned signal is being received.

In the example, both traces have their zero baselines one division from the bottom of the graticule and the vertical and horizontal settings are as recommended above. The trace visible about one division above the center of the graticule is the TP-2 threshold voltage (about 1.8 V). The other trace shows the leading edge of a CW pulse that is being received. This display shows just about ideal reception conditions and is what you should strive for in your tuning. At the baseline of the signal trace, we can see that there is almost no noticeable noise between CW pulses. This situation is rare but does happen occasionally. (Indeed, the photo was taken during reception of a very strong off-the-air signal at about 25 wpm.)

The first step in tuning is to tune the receiver until the tone of the desired CW signal is centered in the filter passband, as evidenced by a maximum signal amplitude for the signal pulse on the oscilloscope display. This will take some care, due to the narrowness of the filter passband. After this condition has been achieved, the next step is to optimize the level of the receiver audio which is being fed to the interface. Making this choice optimally will require a little experience on your part (which will come with time), but I can give you a few hints.

Your primary goal is to maximize the signal-to-noise ratio at the slicer (which is what the TP-1 signal shows). This condition will give you the minimum error rate out of the slicer

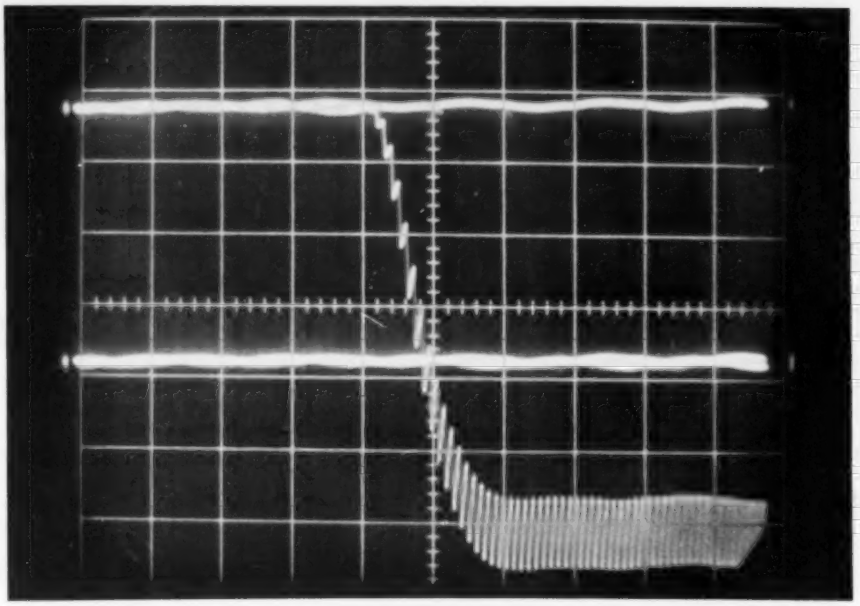


Photo B. Oscilloscope display.

stage, and hence within the decoding algorithm in the computer. Since you have a limiter in the first stage of the interface, you will notice that you can increase the level of the desired signal only up to a point, beyond which it will no longer increase.

You will notice also, however, that if you continue to increase the drive level, the amplitude of the noise and interference evident between pulses *will* increase. This is undesirable. Therefore, you want a condition where the signal gives the greatest difference between the peak of the signal and the peaks of the noise and interference as viewed on the scope. Next, decide whether the normal (high) threshold voltage is best or if the lower threshold would be better. Ideally, the threshold of the slicer should be halfway between the signal peak and the noise peaks. Then, by monitoring the oscilloscope display, you can ensure that the signal remains optimally tuned even if your receiver drifts a small amount or if the noise and interference conditions change.

When using this type of display, it is convenient to have the current slicer threshold (TP-2) superimposed on the display with one channel of the scope, but it is not absolutely necessary. If you have only one single-channel scope, just remember where you have set your threshold, or use an external voltmeter to monitor it while you display the TP-1 signal.

Alternate Tuning Method

As you probably have guessed by now, without an oscilloscope it would be very difficult to adjust the receiver for the optimum conditions described above. This does not mean that you cannot tune it to work fairly well most of the time, however. A VTVM attached to TP-1 also will give an indication of when you have reached maximum signal strength, but its fluctuations with the signal will be much more difficult to interpret. You also will have very little ability to judge the noise conditions between the pulses, but, if you are having a problem, you can compensate for these by doing a little trial and error with the detection threshold and seeing which one works better. You will find that you must tune the receiver slowly in order to find the very narrow passband of the filter.

Summary

This circuit evolved over several months of experimentation and testing, and I think it is a good compromise between circuit complexity and satisfactory performance. I think you will find, however, that while the computer can do a very good job of decoding well-sent Morse code under good reception conditions, the machine is no match for the human brain when it comes to poorly-sent code or very adverse noise or interference conditions. ■

References

1. Thomas, William L., "Decode Morse—With an 8080," *73*, December, 1977.
2. Stark, Peter A., "Design An Active RTTY Filter," *73*, September, 1977.
3. Stewart, Dr. John F., "At Last! A Use For Your Computer," *73*, April, 1978.

Before you buy that won't fill your take a look at

Our General Ledger Package is what we believe to be the best on the market . . . but don't take our word for it—you make the decision!

Our General Ledger System Offers:

A ten-digit alpha-numeric account code that accommodates the most sophisticated structure of accounts with ease.

It can serve small business or, equally well, larger companies needing to control several departments, cost centres, subsidiaries, branches, or various currency accounts and tax divisions.

A free-format code. With no limitations on the use of the account code, you can organize your structure of accounts to suit your company's individual requirements exactly. You can have as many groupings or sections in the structure of accounts as you need. And the number of accounts is governed only by the physical storage capacity of the computer.

If you set up a suitable library of accounts, there are virtually no limits to the ledger's size.

Flexible processing capability and budget control. The system will process accounts for 12 or 13 periods per annum.

It will maintain budgets in whole monetary units.

Comparisons for management decision purposes are readily available for 12 or 13 period processing.

Automatic accrual convenience. The system automatically reverses accrual entries made in the previous period. This simplifies adjusting accounts and improves control.

Simple data throughput. The facility of next-period processing lets you enter next-period transactions before the present period closes. This raises data throughput and allows adjustments to be made in the current period.

Simple seasonal comparisons. The system can maintain details of activities period by period so that comparisons of this year/last year, for example, are quite straightforward.

Account file inquiries on all accounts. You can probe where and when you want. The system will display current and historic budget details, current and prior-period movement, year-to-date balances, all on a single screen display or in a printout.

Transaction file information facility. With over 60 selection options at your disposal, this is a very powerful enquiry feature. Again, the information can be displayed or printed.

Physical audit trails of all new, revised and amended accounts are produced automatically. also audit trails of all transactions, detailing account and reference numbers, type of transaction, description, date, and batch.

A batching facility. There is a built-in technique for controlling input so that all transactions can be batched.

Optimum management control. This system can hold up to 99 separate report riles, each containing up to 9 sub reports. They can draw upon all data on the master files and can be changed or modified as and when you wish.

Typically, standard reports such as trial balances are preprogrammed. But profit and loss statements, cost centre activity, income statements, representative reports, balance sheets and the like can be set out as you want them.

The implications of this for management decision-making are obvious.

Balancing controls. Sophisticated validation techniques ensure the integrity of input data.

Limitless flexibility. Standard ledger accounting is only the start. Depending on how the structure of accounts is designed, the system can undertake project accounting, job/project costing, sales analysis, contract ledger accounting, incomplete record accounting, etc.

Growth capacity. Not every user will need all these functions from the outset. But most features are potentially applicable to most businesses. With such capacities inherent in the system right from the start, you can avoid complexities later.

a computer business needs, software that will!

Extended Software Maintenance Agreement. This agreement will enable you to receive maintenance service as will as enhanced versions of your package.
Technical Support Hot Line. Should you encounter any problems during operation which are not covered in the manual, you can contact our Technical Service Department.

AN ADDED EXTRA:

UTILITY FEATURES

Disk Formatting—allowing you to format new disks without getting into the operating system.
Disk Swapping—allows the user to remove and exchange disks without causing damage to data.
Disk Labeling—enables the user to create labels to put on the disk which contains information identifying a disk in any drive.
Disk Backup—allows the operator to make copies of his data and program disks with ease.
Disk Initialize—allows the newly-formatted disk to be organized to run on our system.
File Move—enables you to move the account, transaction and report files to user specified disks.

To Order: Call Toll Free 1-800-258-5473

or use the order form below

FOR A DEMONSTRATION, SEE YOUR LOCAL INSTANT SOFTWARE DEALER

☐ Please send me more information on your General Ledger package.
☐ Enclosed is $699.00 + $5.00 shipping for my General Ledger package.
☐ CHECK ☐ MC ☐ VISA
Card No. _____
Exp._____ Signature_____

Please send me information on your: ☐ Accounts Payable ☐ Accounts Receivable ☐ Payroll

Name _____
Co. Name _____
Street _____
City _____ State_____ Zip_____

Instant Software™
Peterborough, N.H. 03458 USA A subsidiary of Wayne Green Inc.

Rt. 101 W, Dept. 16
Peterborough, N.H. 03458

Radio Bookshop

NEW from 73

THE NEW WEATHER SATELLITE HANDBOOK

BY DR. RALPH E. TAGGART

Here is the completely updated and revised edition of the best-selling **Weather Satellite Handbook**—containing all the information on the most sophisticated and effective spacecraft now in orbit. Dr. Taggart has written this book to serve both the experienced amateur satellite enthusiast and the newcomer. The book is an introduction to satellite watching, providing all the information required to construct a complete and highly effective ground station. Not just ideas, but solid hardware designs and all the instructions necessary to operate the equipment are included. For the thousands of experimenters who are operating stations, the book details all procedures necessary to modify their equipment for the new series of spacecraft. Amateur weather satellite activity represents a unique blend of interests encompassing electronics, meteorology and astronautics. Join the privileged few in watching the spectacle of earth as seen from space on your own monitoring equipment. **Order BK7383 $8.95**

SAVE $2.95

WEATHER SATELLITE HANDBOOK (first edition)

By Dr. Ralph E. Taggart WB8DQT. Valuable information in this first edition *is not included* in Dr. Taggart's just published book, **The New Weather Satellite Handbook** (see above). Chapters such as "How to Build an Electric Timer for Satellite Tracking" and "Building an Automatic Control for the Satellite Receiving Station" will no longer be available when this edition is out of print. This is a good entry level text for those discovering the exciting new use of weather satellites. Regular price: $4.95. **SPECIAL PACKAGE PRICE--BOTH BOOKS FOR ONLY $10.95, SAVE $2.95!** (This offer available only while supplies last.) Order WS7300 and receive both editions of the Weather Satellite Handbook for only $10.95 (plus $1.00 shipping and handling charge).

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop • Peterborough NH 03458. Be sure to include check or detailed credit card information. Add $1.50 first book, $1.00 each additional book, $10.00 per book foreign airmail. Note: Prices subject to change on books not published by 73 Magazine. Questions regarding your order? Please write to Customer Service at the above address. Please allow 4-6 weeks for delivery. No C.O.D. orders accepted. For Toll Free ordering call 1-800-258-5473.

MAKE MONEY . . . $ELL 73 MAGAZINE

Selling 73 Magazine, the ham radio magazine that offers quality and quantity, brings the ham into your store. Once through the door you can sell him anything.

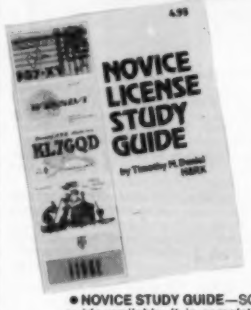
Our dealers are telling us that "73" outsells them all . . . so call today and join the dealers who make money with 73 Magazine.

For information on selling 73 Magazine call 800-258-5473 and speak with Ginnie Boudrieau, our Bulk Sales Manager. Or write to her at:

73 MAGAZINE
80 Pine Street
Peterborough NH 03458

RADIO BOOKSHOP

FOR THE NOVICE



NEW, UPDATED EDITIONS OF OUR FAMOUS NOVICE LICENSE STUDY GUIDE AND NOVICE STUDY TAPES

● **NOVICE STUDY GUIDE**—SG7357—by Timothy M. Daniel N8RK. Here is the most up to date novice guide available. It is complete with information about learning Morse Code, has the latest FCC amateur regulations and the current FCC application forms. This guide *is not* a question/answer memorization course but rather it emphasises the practical side of getting a ham license and putting a station on the air. It reflects what the FCC expects a Novice to know without page after page of dull theory. The most current information still available at last year's price. $4.95

● **NOVICE STUDY TAPES**—CT7300—If you are just getting started in ham radio, you'll find these tapes indispensable! This up-to-the-minute revision of the 73 Study Course is the perfect way to learn everything you need to breeze through the Novice written exam. Theory, FCC regulations, and operating skills are all covered, and you'll be amazed at how fast you learn using these tapes!

Once the test is behind you, these tapes will go right on being useful, because they are packed with the latest information on setting up your own ham station, and getting on the air.

Thousands of people have discovered how easy learning from cassette can be—order now and enter the fascinating world of ham radio!—Set of 3—$15.95.*

Scientists have proven that you learn faster by listening than by reading because you can play a cassette tape over and over in your spare time—even while you're driving! You get more and more info each time you hear it. You can't progress without solid fundamentals. These three hour-long tapes give you all the basics you'll need to pass the Novice exam easily. You'll have an understanding of the basics which will be invaluable to you for the rest of your life! Can you afford to take your Novice exam without first listening to these tapes?

SPECIAL OFFER! Both Novice License Study Guide and Novice Study Tapes $19.95. Order NP7300.

73 CODE TAPES

ANY FOUR TAPES FOR $15.95! $4.95 EACH

"GENESIS"

5 WPM—CT7305—This is the beginning tape for people who do not know the code at all. It takes them through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way using the newest blitz teaching techniques. It is almost miraculous! In one hour many people—including kids of ten—are able to master the code. The ease of learning gives confidence to beginners who might otherwise drop out.

"THE STICKLER"

6+ WPM—CT7306—This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly—under pressure—faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five.

"BACK BREAKER"

13+ WPM—CT7313—Code groups again, at a brisk 14 per so you will be at ease when you sit down in front of the steely-eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test, you'll thank heaven you had this back-breaking tape.

"COURAGEOUS"

20+ WPM—CT7320—Code is what gets you when you go for the Extra class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape.

"OUTRAGEOUS"

25+ WPM—CT7325—This is the tape for that small group of overachieving hams who wouldn't be content to simply satisfy the code requirements of the Extra Class license. It's the toughest tape we've got and we keep a permanent file of hams who have mastered it. Let us know when you're up to speed and we'll inscribe your name in 73's CW "Hall of Fame."

new General License Study Guide —

GENERAL LICENSE STUDY GUIDE—by Timothy M. Daniel N8RK. This is the complete guide to the General License. Learning rather than memorizing is the secret. This is not a question-and-answer guide that will gather dust when the FCC issues a new test. Instead, this book will be a helpful reference, useful long after a ham upgrades to General. Includes up-to-date FCC rules and an application form. Order yours today and talk to the world. SG7358 $8.95

● **ADVANCED CLASS LICENSE STUDY GUIDE**—SG1081—Ready to upgrade your license? To prevent retaking the FCC theory exam, you need the 73 Advanced theory guide. SSB, antenna theory, transmitters, and electronics measuring techniques are covered in detail in this easy-to-follow study guide. Special modes and techniques, such as RTTY, are also treated. An engineering degree is *not* necessary to master the Advanced theory—try this book before visiting the examiner's office! $6.95.* (Published by TAB Books previous to recent changes in FCC exam material.)

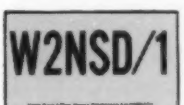
—SSTV TAPE—

● **SLOW SCAN TELEVISION TAPE**—CT7350—Prize-winning programs from the 73 SSTV contest. Excellent for Demo! $5.95.*

FOR YOUR HAMSHACK

● **QSL CARDS**—*73* turns out a fantastic series of QSL cards at about half the cost of having them done elsewhere because they are run as a fill-in between printing books and other items in the 73 Print Shop. 250 Style W—QW0250—for $8.95*; 500 Style W—QW0500—for $13.95*; 250 Style X—QX0250—for $8.95*; 500 Style X—QX0500; 250 Style Y—QY0250—for $8.95*; 500 Style Y—QY0500—for $13.95.* Allow 6-12 wks. for delivery.

● **LIBRARY SHELF BOXES**—These sturdy white, corrugated, dirt-resistant boxes each hold a full year of *73, Kilobaud Microcomputing or 80 Microcomputing.* With your order, request self-sticking labels for any of the following: *73, Kilobaud Microcomputing, 80 Microcomputing, CQ, QST, Ham Radio, Personal Computing, Radio Electronics, Interface Age,* and *Byte.* Order 1—BX1000—for $2.00*; order 2-7—BX2002—for $1.50 each*; order 8 or more—BX1002—for $1.25 each*.



Style Y

Style W

Style X

● Preserve and protect your collection for a lifetime! Order these handsome red binders with gold lettering. $7.50 for 1, 3 for $21.75, 6 for $42.00. (Postpaid within USA, please add $2.50 per order outside USA.) *Check or money orders only, no phone or C.O.D. orders.* **73 Binders, P.O. Box 5120, Philadelphia, PA 19141.**

***NOTE—Above address for Binders only.**

73 MAGAZINE BINDERS

BACK ISSUES

● **BACK ISSUES**—Complete your collection; many are prime collectables now, classics in the field! A full collection is an invaluable compendium of radio and electronics knowledge!

ST0000—Single back issue before July 1980 ..... $3.00
ST0250—Single back issue July 1980 on. $3.50
ST0500—5 your choice. $8.75
Add $1.00 per magazine for shipping.
ST1000—10 your choice. $14.00
ST2500—25 our choice. $12.00
ST2501—25 your choice. $25.00
Add $7.50 per order for shipping.

● **FREE BACK ISSUE CATALOGS** are yours for the asking . . . specify *73 Magazine,* and/or *Kilobaud Microcomputing,* back issue catalog when you send your name and address to us on a postcard.

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop ● Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. All orders add $1.50 handling first book, $1.00 each additional book, $10.00 per book foreign airmail. Please allow 4-6 weeks for delivery. Questions regarding your order? Please write to Customer Service at the above address. (Prices subject to change on books not published by 73 Magazine.)

FOR TOLL FREE ORDERING CALL 1-800-258-5473

RADIO BOOKSHOP

THE 73 TECHNICAL LIBRARY

BEHIND THE DIAL—by Bob Grove. Get more fun out of shortwave listening with this interesting guide to receivers, antennas, frequencies, and interference. $4.95.* BK7307

THE CHALLENGE OF 160—is the newest book in the 73 technical library, dedicated to 160-meter operating. Si Dunn provides all necessary information to get started on this unique band. The all-important antenna and ground systems are described in detail. The introduction contains interesting photos of Stew Perry's (the King of 160) shack. This reference is a must for new and experienced "Top Band" operators. Price: $4.95.* BK7309

SSB...THE MISUNDERSTOOD MODE—by James B. Wilson. Single Sideband Transmission...thousands of us use it every day, yet it remains one of the least understood facets of amateur radio. J. B. Wilson presents several methods of sideband generation, amply illustrated with charts and schematics, which will enable the ambitious reader to construct his own sideband generator. A must for the technically-serious ham. $5.50.* BK7351

PROPAGATION WIZARD'S HANDBOOK— by J. H. Nelson. When sunspots riddled the worldwide communications networks of the 1940s, John Henry Nelson looked to the planets for an answer. The result was a theory of propagation forecasting based upon interplanetary alignment that made the author the most reliable forecaster in America today. The book provides an enlightened look at communications past, present, and future, as well as teaching the art of propagation forecasting. $6.95.* BK7302

●TOOLS & TECHNIQUES FOR ELECTRONICS—BK7348—by A. A. Wicks is an easy-to-understand book written for the beginning kit builder as well as the experienced hobbyist. It has numerous pictures and descriptions of the safe and correct ways to use basic and specialized tools for electronic projects as well as specialized metal working tools and the chemical aids which are used in repair shops. $4.95.*

new

WORLD PRESS SERVICE FREQUENCIES—by Thomas Harrington. Can't wait to hear the evening news, or are you wondering about the news that you *aren't* hearing? Receive by Radio Teletype (RTTY) *all* the world news and financial happenings from the world capitols on a 24 hour a day basis. This book gives you the frequencies and times of broadcast of such news services as AP, UPI, Reuters, TASS, VOA and London Press. Also included is an introduction to RTTY with information on equipment, antennas, abbreviations—everything you need to get started in RTTY. $5.95* BK1202

NEW!

THE NEW WEATHER SATELLITE HANDBOOK— by Dr. Ralph E. Taggart WB8DQT. Here is the completely updated and revised edition containing all the information on the most sophisticated and effective spacecraft now in orbit. This book serves both the experienced amateur satellite enthusiast and the newcomer. It is an introduction to satellite watching, providing all the information required to construct a complete and highly effective ground station. Solid hardware designs and all the instructions necessary to operate the equipment are included. For experimenters who are operating stations, the book details all procedures necessary to modify equipment for the new series of spacecraft. Amateur weather satellite activity represents a unique blend of interests encompassing electronics, meteorology and astronautics. Join the privileged few in watching the spectacle of earth as seen from space on your own monitoring equipment. $8.95.* BK7383

FOR THE CONTESTER

THE CONTEST COOKBOOK—reveals the secrets of the contest winners (domestic, DX, and specialty contests), complete with photos and diagrams of equipment used by the top scorers. Find out how to make 150 contacts in one hour. $5.95.* BK7308

INTERFERENCE HANDBOOK—by William R. Nelson, WA6EQG—This timely handbook covers every type of RFI problem and gives you the solutions based on practical experience. Covers interference to TV, radio, hi-fi, telephone, radio amateur, commercial and CB equipment. Power line interference is covered in depth—how to locate it, cure it, work with the public, safety precautions, how to train RFI investigators. Written by an RFI expert with 33 years of experience, this profusely illustrated book is packed with practical easy-to-understand information. BK1230 $8.95

IC OP-AMP COOKBOOK—by Walter G. Jung. Covers not only the basic theory of the IC op amp in great detail, but also includes over 250 practical circuit applications, liberally illustrated. 592 pages, 5½ × 8½, softbound. $14.95.* BK1028

OWNER REPAIR OF RADIO EQUIPMENT—by Frank Glass K6RQ. Here's a book that will teach you an approach to troubleshooting without a shack full of test equipment. Written in a narrative, non-mathematical style, it will encourage you to successfully fix your own rig problems 80 to 90% of the time. Even if you don't want to fix, you can learn a lot about how things work and fail. Add to your library and personal expertise. $7.95.* BK7310

HANDBOOKS FOR THE HAMSHACK

THE TEN METER FM HANDBOOK—by Bob Heil K9EID. This handbook has been published to help the ten meter enthusiast learn more about the many methods of conversions and tricks that are used to make existing units work better. Join the great "tinkerers" of the world on ten FM and enjoy the fantastic amount of fun in communicating with amateur stations worldwide on ten meter FM. $4.95.* BK1190

THE PRACTICAL HANDBOOK OF AMATEUR RADIO FM REPEATERS—by Bill Pasternak WA6ITF (author of 73 Magazines monthly column "Looking West") This is the book for the VHF/UHF FMer, compiled from material submitted by over a hundred individuals, clubs, organizations and equipment manufacturers. A "must have" for your ham shack shelf. $12.95.* BK1185

The 73 Test Equipment Library

VOL. I COMPONENT TESTERS—How to build transistor testers (5), diode testers (3), IC testers (3), voltmeters and VTVMs (9), ohmmeters (6 different kinds), inductance (3), capacity (9), Q measurement, crystal checking (6), temperature (2), aural meters for the blind (3), and all sorts of miscellaneous data on meters...using them, making them more versatile, making standards. Invaluable book. $4.95.* LB7359

VOL. II AUDIO FREQUENCY TESTERS—Jam-packed with all kinds of audio frequency test equipment. If you're into SSB, RTTY, SSTV, etc., this book is a must for you...a good book for hi-fi addicts and experimenters, too! $4.95.* LB7360

VOL. III RADIO FREQUENCY TESTERS—Radio frequency waves, the common denominator of amateur radio. Such items as swr, antenna impedance, line impedance, rf output, and field strength; detailed instructions on testing these items includes sections on signal generators, crystal calibrators, grid-dip oscillators, noise generators, dummy loads, and much more. $4.95.* LB7361

VOL. IV IC TEST EQUIPMENT—Become a troubleshooting wizard! In this fourth volume of the 73 TEST EQUIPMENT LIBRARY are 42 home construction projects for building test equipment to work with your ham station and in servicing digital equipment. Includes a cumulative index for all four volumes for the 73 TEST EQUIPMENT LIBRARY. $4.95.* LB7362

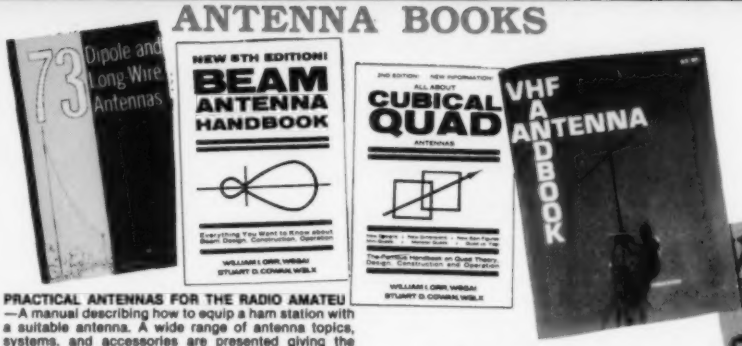
RF AND DIGITAL TEST EQUIPMENT YOU CAN BUILD—BK1044—Rf burst, function, square wave generators, variable length pulse generators—100 kHz marker, i-f and rf sweep generators, audio osc, af/rf signal injector, 146 MHz synthesizer, digital readouts for counters, several counters, prescaler, microwave meter, etc. 252 pages. $5.95.* BK1044

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop ● Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. All orders add $1.50 handling first book, $1.00 each additional book, $10.00 per book foreign airmail. Please allow 4-6 weeks for delivery. Questions regarding your order? Please write to Customer Service at the above address. (Prices subject to change on books not published by 73 Magazine.)

FOR TOLL FREE ORDERING CALL 1-800-258-5473

RADIO BOOKSHOP

ANTENNA BOOKS



PRACTICAL ANTENNAS FOR THE RADIO AMATEU—A manual describing how to equip a ham station with a suitable antenna. A wide range of antenna topics, systems, and accessories are presented giving the reader some food for thought and practical data for construction. Designed to aid the experienced ham and novice as well. Only BK1015 $9.95.*

VHF ANTENNA HANDBOOK—The new *VHF Antenna Handbook* details the theory, design, and construction of hundreds of different VHF and UHF antennas...a practical book written for the average amateur who takes joy in building, not full of complex formulas for the design engineer. Packed with fabulous antenna projects you can build. $5.95.* BK7368

73 DIPOLE AND LONG-WIRE ANTENNAS—by Edward M. Noll W3FQJ. This is the first collection of virtually every type of wire antenna used by amateurs. Includes dimensions, configurations, and detailed construction data for 73 different antenna types. Appendices describe the construction of noise bridges, line tuners, and data on measuring resonant frequency, velocity factor, and swr. $5.50.* BK1016

● **ALL ABOUT CUBICAL QUAD ANTENNAS (2nd edition)—BK1196—The "Classic" on Quad design, theory, construction, and operation. New 2nd edition contains new feed and matching systems and new data. $5.95.***

● **BEAM ANTENNA HANDBOOK (New 5th edition)**—BK1197—Yagi beam theory, construction and operation. Information on wire beams, SWR curves and matching systems. A "must" for serious DXers. $5.95*

● **VHF HANDBOOK FOR RADIO AMATEURS**—BK1198—Contains information on FM theory, operation and equipment, VHF antenna design and construction, satellite-EME, and the newest solid-state circuits. $6.95*

● **THE RADIO AMATEUR ANTENNA HANDBOOK**—BK1199—All about wire antennas, beams, tuners, baluns, coax, radials, SWR and towers. Clear and complete information. $6.95*

● **SIMPLE, LOW-COST WIRE ANTENNAS FOR RADIO AMATEURS**—BK1200—All new data and everything you want to know about low-cost, multi-band antennas, inexpensive beams, "invisible" antennas for hams in "tough" locations. $6.95*

THE WELL EQUIPPED HAM SHACK

COOK BOOKS

TTL COOKBOOK—by Don Lancaster. Explains what TTL is, how it works, and how to use it. Discusses practical applications, such as a digital counter and display system, events counter, electronic stopwatch, digital voltmeter and a digital tachometer. $9.50.* BK1063

CMOS COOKBOOK—by Don Lancaster. Details the application of CMOS, the low power logic family suitable for most applications presently dominated by TTL. Required reading for every serious digital experimenter! $10.50.* BK1011

TVT COOKBOOK—by Don Lancaster. Describes the use of a standard television receiver as a microprocessor CRT terminal. Explains and describes character generation, cursor control and interface information in typical, easy-to-understand Lancaster style. $9.95.* BK1064

SPECIAL OFFER

Chart of
UNITED STATES AMATEUR RADIO PRIVILEGES

by class of license, emission type, and frequency from 160 thru 2 meters, including provision for the new 30, 17, and 12 meter bands. This 22 x 28 in. twelve-color chart is the first of its kind to be both informative and decorative. $3.00 value, only $1.95 with the purchase of 1 or more books from the Radio Bookshop. (Supplies limited, order now.) CH7300 $1.95.

WORLD REPEATER ATLAS—Completely updated, over 230 pages of repeater listings are indexed by location and frequency. More than 50 maps pinpoint 2000 repeater locations throughout the USA. Foreign listings include Europe, the Middle East, South America, and Africa. $4.95* BK7315

THE MAGIC OF HAM RADIO—by Jerrold Swank W8HXR begins with a brief history of amateur radio and of Jerry's involvement in it. Part 2 details many of ham radio's heroic moments. Hamdom's close ties with the continent of Antarctica are the subject of Part 3. In Part 4 the strange and humorous sides of ham life get their due. And what of the future? Part 5 peers into the crystal ball. $4.95.* BK7312

A GUIDE TO HAM RADIO—by Larry Kahaner WB2NEL. What's Amateur Radio all about? You can learn the basics of this fascinating hobby with this excellent beginner's guide. It answers the most frequently asked questions in an easy-going manner, and it shows the best way to go about getting an FCC license. A Guide to Ham Radio is an ideal introduction to a hobby enjoyed by people around the world. $4.95.* BK7321

● **HOW TO DEFEND YOURSELF AGAINST RADAR**—BK1201—by Bruce F. Bogner and James R. Bodnar, a lawyer and radar expert. This book gives you the ammunition to challenge the radar "evidence" that usually leads to a speeding conviction. The major part of the book details the inner workings of radar—you'll become more of an expert than most police officers and judges. The remainder of the book outlines how to defend yourself against a speeding ticket—the observations, measures and testimony you must obtain to defend yourself without the help of a lawyer. The price is a lot less than a fine! $6.95*

WORLD RADIO TV HANDBOOK 1982, 25TH EDITION—This book is the bible of international broadcasters, providing the only authoritative source of exact information about broadcasting and TV stations world wide. This 1981 edition is completely revised, giving comprehensive coverage of short, medium and long wave, 560 pages of vital aspects of world listening. $16.50. BK1184

MICROCOMPUTER BOOKS FROM 73

Some of the Best from
How to Build a Microcomputer
40 COMPUTER GAMES
from
kilobaud microcomputing
Includes: Gambling, Racing, Space, Board Games, Card Games, Guessing Games, Puzzles, Calculators, Odds & Ends

● **SOME OF THE BEST FROM KILOBAUD/MICROCOMPUTING**—BK7311—A collection of the best articles that have recently appeared in Kilobaud/ MICROCOMPUTING. Included is material on the TRS-80 and PET systems, CP/M, the 8080/8085/Z80 chips, the ASR-33 terminal. Data base management, word processing, text editors and file structures are covered too. Programming techniques and hardcore hardware construction projects for modems, high speed cassette interfaces and TVTs are also included in this large format, 200 plus page edition. $10.95.*

● **40 COMPUTER GAMES**—BK7361—Forty games in all in nine different categories. Games for large and small systems, and even a section on calculator games. Many versions of BASIC used and a wide variety of systems represented. A must for the serious computer gamesman. $7.95*

● **THE NEW HOBBY COMPUTERS**—BK7340—This book takes it from where "HOBBY COMPUTERS ARE HERE!" leaves off, with chapters on Large Scale Integration, how to choose a microprocessor chip, an introduction to programming, low cost I/O for a computer, computer arithmetic, checking memory boards...and much, much more! Don't miss this tremendous value! Only $4.95.*

● **UNDERSTANDING AND PROGRAMMING MICROCOMPUTERS**—BK7382—A valuable addition to your computing library. This two-part text includes the best articles that have appeared in 73 and Kilobaud Microcomputing magazines on the hardware and software aspects of microcomputing. Well-known authors and well-structured text helps the reader get involved. $10.95*

HOW TO BUILD A MICROCOMPUTER—AND REALLY UNDERSTAND IT—by Sam Cresson. The electronics hobbyist who wants to build his own microcomputer system now has a practical "How-To" guidebook. This book is a combination technical manual and programming guide that takes the hobbyist step-by-step through the design, construction, testing, and debugging of a complete microcomputer system. Must reading for anyone desiring a true understanding of small computer systems. $9.95.* BK7352

HOBBY COMPUTERS ARE HERE!If you want to come up to speed on how computers work—hardware and software—this is an excellent book. It starts with fundamentals and explains the circuits and the basics of programming, along with a couple of TVT construction projects, ASCII, Baudot, etc. This book has the highest recommendations as a teaching aid. $4.95.* BK7322

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop ● Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. All orders add $1.50 handling first book, $1.00 each additional book, $10.00 per book foreign airmail. Please allow 4-6 weeks for delivery. Questions regarding your order? Please write to Customer Service at the above address. (Prices subject to change on books not published by 73 Magazine.)

FOR TOLL FREE ORDERING CALL 1-800-258-5473

List of Advertisers

*Please contact these advertisers directly.

To receive full information from our advertisers please complete the following postage-paid card.

R.S. No.		Page
2	AEA/Advanced Electronic Applications	23
329	AR Technical Products	83
448	Advanced Communications International	37
406	Alaska Microwave Labs.	77
20	All Electronics	39
482	Aluma Tower	136
*	Amateur Electronic Supply	63
5	Amateur Wholesale Electronics	25
331	Amateur-Wholesale Electronics	45
334	Amidon Associates	145
7	American Crystal Supply	153
97	AMP Letter	153
*	Antenna Bank	147
*	Associated Radio	146
*	Autek Research	147
469	BG Carl Electronics	100
11	Barker & Williamson	149
305	Barry Electronics	59
26	Bash Educational Services	58
440	Rex Bassett Electronics, Inc.	73, 152
420	Benjamin Michael Industries	147
*	Britt's Two-Way Radio/AEA	145
12	Bullet Electronics	156
*	Butternut Electronics	31
*	C & A Roberts/AEA	69
321	Certified International	154
89	Clutterfree Modular Consoles	148
*	Code Quick	154
59	Commsoft	101
28	Communications Center, NE	172
382	Communication Concepts, Inc.	145
377	Communications Electronics	157
462	Communications Electronic Specialties	151
15	Communications Specialists	10, 11
444	Computer Plus	154
*	Crown Micro Products	71, 152
70	Cubic Communications	57
307	Debco Electronics	138
*	Derrick Electronics/AEA	150
*	Desktop Computing	141
477	DFD Systems	119
*	DGM Electronics, Inc.	142
*	Digital Research Parts	175
43	DNE, Inc.	138
425	Doppler Systems	154
*	R. L. Drake Company	91
*	DXpeditions International	62
453	E.G.E., Inc.	142
*	80 Microcomputing	144
*	Electronic Equipment Bank	145
447	Electronic Hobby Innovations	101
82	Electronic Recyclers of MA	153
400	Engineering Consulting	154
*	Erickson Communications	62
91	ETCO Electronics	149
85	Faxscan, Inc.	138
439	Ben Franklin Electronics	155
323	Fox-Tango Corp.	98
483	Frontier Enterprises	136
101	G & K Amateur Supply	23
37	Gillaspie & Associates	99
*	Gam Quad Products Ltd.	75
*	Global Electronics	99
417	Gotham Antenna	156
*	Grove Enterprises	46
9	HMRII	154
86	H & R Communications	86
345	Hal Communications	17
479	Hal Communications	136
31	Hal-Tronix	137
*	Ham Radio Outlet	3
33	Hamtronics, NY	173
460	Handi-Tek	154
18	Hastings Antenna	86
55	Heath Company	37
303	Heath Company	9
34	Henry Radio	55
72	higain Electronics	98
316	Hy-Gain Div. of Telex Comm.	47, 84, 85
320	Hoosier Electronics	95
*	Hustler, Inc.	43
474	IIX Equipment	49
*	ICOM	Cov II, 29
*	IRL	15
78	Independent Crystal Supply Co.	153
6	Indy Amateur Supply	155
35	Info-Tech	62
445	Instant Software Dealers	103
	Amateur Radio Programs	102, 108, 109
27	Iscan Engineering	155
409	JDR Microdevices	116, 117
25	JJT Distributing	155
38	Jameco Electronics	177
*	KB Microcomputing	144
81	KDK Distributing	19
476	KDK Distributing	118
*	Kantronics	150
*	Kenwood	Cov IV, 7
4	Lacue Communications Electronics	151
457	Lewis Construction Co.	100
*	Live Via Satellite, Inc.	99
480	LNR Communications	135
53	Luty Associates	99
98	M & M Electronics Sales	32
47	MFJ Enterprises	67, 69, 71, 73, 75, 77, 88
478	MFJ Enterprises	135
48	MHz Electronics	158-167
77	M-Squared Engineering	150
56	Macaw Electronics	148
44	Macrotronics, Inc.	75
45	Madison Electronics Supply	151
46	Maggiore Electronics	140
139	Memphis Amateur Electronics	28
49	Micro Control Specialties	77
51	Microlog	79
313	Micro Management Systems	155
50	Microcraft Corp.	69, 156
52	Mid-Com Electronics	148
308	J. W. Miller Div./Bell Industries	31, 33
*	Mirage Comm. Equip., Inc.	73
318	National Comm. Group	100, 139
412	Nemal Electronics	46
327	Nordlund & Associates	99
*	Orbit Magazine	137
*	P.C. Electronics	100
*	Palomar Engineers	4
404	P. B. Radio Service	152
421	Phillips Tech Electronics	153
300	Pipo Communications	153
96	Power Gain Antennas	33
450	QRO Engineering	138
94	QRZ Scan, Inc.	49
80	Quest Electronics	168
21	R.W.D., Inc.	149
61	Radio Amateur Callbook, Inc.	33
*	Radio Publications	119
381	Radio Systems Technology, Inc.	153
454	Radiokit	69
397	Radio World	156
*	Radios Unlimited/AEA	24
62	Ramsey Electronics	169, 174
418	Rolin Distributors	24
95	S. G. Roscoe	39
376	SMP	151
65	S-F Amateur Radio Service	71
64	Semiconductors Surplus	170, 171
*	73 Magazine Books	110-113, 143, 144
	Dealers Ad	110
	"Moving"	137
	Subscriptions	115, 154
	University Microfilms	155
*	Sherwood Engineering	155
433	Skytec	154
367	Slep Electronics	139
309	Spacecoast Research Corp.	98
*	Spectronics, Inc.	71, 176
68	Spectrum Communications	81
436	Spectrum International, Inc.	100, 139
32	Stellmaker Enterprises	155
30	Strux Corp.	153
69	Surplus Electronics Corp.	155
316	Telex Communications, Inc.	47, 84, 85
*	Ten-Tec, Inc.	135
328	Texas Microtronics	49
449	The Ham Shack	152
57	The Tuned Antenna Co.	67
76	Trac Electronics	43
86	Tufts Electronics	60, 61
*	Universal Communications	140
*	Van Gorden Engineering	43
481	Valor Enterprises	136
311	Vanguard Labs	153
90	VoCom Products Co.	39
302	W-S Engineering	73
79	Wacom Products	156
*	Wessex Publishing Co.	138
29	Windward, Inc.	24
83	Yaesu Electronics Co.	Cov III

73 MAGAZINE

Books, ETC.

To order, complete the following postage-paid card, or itemize your order including detailed credit card information or check and mail to:
73 Magazine/Mail Order Dept./Peterborough NH 03458.

Catalog #	Item	Price
BK1018	73 DIPOLE & LONG WIRE ANTENNAS	$ 5.50
ST0000	73 BACK ISSUE	$ 3.00
ST2500	73 BACK ISSUES—25 OUR CHOICE	$12.00
ST0500	73 BACK ISSUES—5 YOUR CHOICE	$ 8.75
ST1000	73 BACK ISSUES—10 YOUR CHOICE	$14.00
ST2501	73 BACK ISSUES—25 YOUR CHOICE	$25.00
BK1196	ALL ABOUT CUBICAL QUAD ANTENNAS	$ 5.95
BK1197	BEAM ANTENNA HANDBOOK	$ 5.95
BK7307	BEHIND THE DIAL	$ 4.95
BK7309	CHALLENGE OF 160	$ 4.95
BK1011	CMOS COOKBOOK	$10.50
CT7305	CODE TAPE—5 WPM	$ 4.95
CT7306	CODE TAPE—6 + WPM	$ 4.95
CT7313	CODE TAPE—13 + WPM	$ 4.95
CT7320	CODE TAPE—20 + WPM	$ 4.95
CT7325	CODE TAPE—25 + WPM	$ 4.95
CT7394	CODE TAPES (ANY FOUR ABOVE)	$15.95
BK7308	THE CONTEST COOKBOOK	$ 5.95
BK7381	40 COMPUTER GAMES	$ 7.95
SG7356	GENERAL LICENSE STUDY GUIDE	$ 6.95
BK7304	GIANT BOOK OF AMATEUR RADIO ANTENNAS	$12.95
BK7321	A GUIDE TO HAM RADIO	$ 4.95
BK7322	HOBBY COMPUTERS ARE HERE	$ 4.95
BK7325	HOW TO BUILD A MICROCOMPUTER & REALLY UNDERSTAND IT	$ 9.95
BK1201	HOW TO DEFEND YOURSELF AGAINST RADAR	$ 6.95
BK1028	IC OP AMP COOKBOOK	$12.95
BK1230	INTERFERENCE HANDBOOK	$ 8.95
BK7312	MAGIC OF HAM RADIO	$ 4.95
BK1033	MASTER HANDBOOK OF HAM RADIO CIRCUITS	$ 8.95
BK7340	THE NEW HOBBY COMPUTERS	$ 4.95
BK7383	THE NEW WEATHER SATELLITE HANDBOOK	$ 8.95
CT7300	NOVICE THEORY TAPES	$15.95
BK7310	OWNER REPAIR OF RADIO EQUIPMENT	$ 7.95
BK7305	POWER SUPPLY HANDBOOK	$ 9.95
BK1015	PRACTICAL ANTENNAS FOR THE RADIO AMATEUR	$ 9.95
BK1185	THE PRACTICAL HANDBOOK OF FM REPEATERS	$ 9.95
BK7302	PROPAGATION WIZARD'S HANDBOOK	$ 6.95
QW0250	QSL CARDS—STYLE W—250	$ 6.95
QW0500	QSL CARDS—STYLE W—500	$13.95
QX0250	QSL CARDS—STYLE X—250	$ 8.95
QX0500	QSL CARDS—STYLE X—500	$13.95
QY0250	QSL CARDS—STYLE Y—250	$ 8.95
QY0500	QSL CARDS—STYLE Y—500	$13.95
BK1199	THE RADIO AMATEUR ANTENNA HANDBOOK	$ 6.95
BK1044	RF & DIGITAL TEST EQUIPMENT	$ 5.95
BK1059	RTL COOKBOOK	$ 6.50
BX1000	SHELF BOX—1	$ 2.00
BX1001	SHELF BOXES—2-7	$1.50 each
BX1002	SHELF BOXES—8 AND UP	$1.25 each
BK1200	SIMPLE, LOW COST WIRE ANTENNAS FOR RADIO AMATEURS	$ 6.95
BK7311	SOME OF THE BEST FROM KILOBAUD	$10.95
BK7311	SOME OF THE BEST	$ 7.95
BK7351	SSB THE MISUNDERSTOOD MODE	$ 5.50
CT7350	SSTV TAPE	$ 5.95
SG1081	STUDY GUIDE—ADV. CLASS	$ 6.95
SG1080	STUDY GUIDE—EXTRA CLASS	$ 5.95
SG7357	STUDY GUIDE—NOVICE CLASS	$ 4.95
BK1190	THE TEN METER FM HANDBOOK	$ 4.95
LB7359	TEST EQUIP LIB V1—COMPONENT TESTERS	$ 4.95
LB7360	TEST EQUIP LIB V2—AUDIO TESTERS	$ 4.95
LB7361	TEST EQUIP LIB V3—RADIO EQUIP.	$ 4.95
LB7362	TEST EQUIP LIB V4—IC TEST EQ.	$ 4.95
BK7348	TOOLS & TECHNIQUES	$ 4.95
BK1083	TTL COOKBOOK	$ 9.50
BK1084	TVT COOKBOOK	$ 8.95
BK7382	UNDERSTANDING & PROGRAMMING MICROCOMPUTERS	$10.95
CH7300	U.S. AMATEUR RADIO CHART	$1.95
BK1089	VERTICAL BEAM & TRIANGLE ANTNS	$ 5.50
BK7388	VHF ANTENNA HANDBOOK	$ 5.95
BK1198	VHF HANDBOOK FOR RADIO AMATEURS	$ 6.95
BK7370	WEATHER SATELLITE HANDBOOK	$ 2.50
BK1202	WORLD PRESS SERVICE FREQUENCIES	$ 5.95
BK1184	WORLD RADIO TV HANDBOOK	$18.50
BK7315	WORLD REPEATER ATLAS	$ 4.95

READER SERVICE

Please help us to bring you a better magazine—by answering these questions.

A. What is your education?
1. High School
2. Some College
3. College Graduate
4. Post Graduate

B. What is your yearly income?
1. Less than $10,000
2. $10,000-$15,000
3. $15,000-$20,000
4. $20,000-$25,000
5. $25,000-$30,000
6. More than $30,000

C. How much have you spent on amateur radio in the last 12 months?
1. Less than $100
2. $100-$500
3. $501-$2,000
4. $More than $2,000

D. What brand(s) of antenna(s) do you own?
1. AEA
2. Antenna Specialists
3. Avanti
4. B & W
5. Barker
6. Bilal
7. Butternut
8. Cushcraft
9. Daiwa
10. HWT Tonna
11. Genn
12. Hustler
13. Hy-Gain
14. Hustler
15. Hy-Gain
16. [illegible]
17. KLM
18. Knott
19. Larsen
20. Lotar
21. Mini-Gain
22. Mosley
23. Shybrew
24. Stewart
25. Telrex
26. TET
27. Van Gorden
28. Weskent Electronics
29. Wilson
30. Other

E. What brands of HF and VHF equipment do you own?
1. Atlas
2. Drake
3. Collins
4. Drake
5. Heath
6. Hy-Gain
7. Icom
8. KDK
9. Kenwood
10. KLM
11. Mirco
12. NOS
13. Santec
14. Swan Cubic
15. Tempo
16. Ten-Tec
17. Wilson
18. Yaesu
19. Other

F. Are you now on RTTY?
1. Yes
2. No

G. If not, are you interested in getting RTTY?
1. Yes
2. No

H. Would you favor a no-code license if ham clubs were placed in charge of licensing?
1. Yes
2. No

I. Would you like to see articles on satellite TV in 73?
1. Yes
2. No

J. Which of these magazines do you read regularly?
1. 73
2. Ham Radio
3. QST
4. World Radio
5. Popular Electronics
6. Radio Electronics
7. CQ

K. How many people read your copy of 73?
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6 or more

Reader Service: Return this card to receive full information on the products advertised in this issue. Refer to the ad. You will find numbers near the logo of each advertiser. Each represents the advertiser's individual Reader Service Number. Circle the corresponding numbers on the card on this page, include your name, address & zip, and drop in a mailbox. In 4-6 weeks you'll hear from the advertiser directly.

This card is valid until March 31, 1982

If you are not a subscriber, please circle 500

1	6	11	16	21	126	131	136	141	146	251	256	261	266	271	376	381	386	391	396
2	7	12	17	22	127	132	137	142	147	252	257	262	267	272	377	382	387	392	357
3	8	13	18	23	128	133	138	143	148	253	258	263	268	273	378	383	388	393	398
4	9	14	19	24	129	134	139	144	149	254	259	264	269	274	379	384	389	394	399
5	10	15	20	25	130	135	140	145	150	255	260	265	270	275	380	395	390	395	400
26	31	36	41	46	151	156	161	166	171	276	281	286	291	296	401	406	411	416	421
27	32	37	42	47	152	157	162	167	172	277	282	287	292	297	402	407	412	417	422
28	33	38	43	48	153	158	163	168	173	278	283	288	293	298	403	408	413	418	423
29	34	39	44	49	154	159	164	169	174	279	284	289	294	299	404	409	414	419	424
30	35	40	45	50	155	160	165	170	175	280	285	290	295	300	405	410	415	420	425
51	56	61	66	71	176	181	186	191	196	301	306	311	316	321	426	431	436	441	446
52	57	62	67	72	177	182	187	192	197	302	307	312	317	322	427	432	437	442	447
53	58	63	68	73	178	183	188	193	198	303	308	313	318	323	428	433	438	443	448
54	59	64	69	74	179	184	189	194	199	304	309	314	319	324	429	434	439	444	449
55	60	65	70	75	180	185	190	195	200	305	310	315	320	325	430	435	440	445	450
76	81	86	91	96	201	206	211	216	221	326	331	336	341	346	451	456	461	466	471
77	82	87	92	97	202	207	212	217	222	327	332	337	342	347	452	457	462	467	472
78	83	88	93	98	203	208	213	218	223	328	333	338	343	348	453	458	463	468	473
79	84	89	94	99	204	209	214	219	224	329	334	339	344	349	454	459	464	469	474
80	85	90	95	100	205	210	215	220	225	330	335	340	345	350	455	460	465	470	475
101	106	111	116	121	226	231	236	241	246	351	356	361	366	371	476	481	486	491	496
102	107	112	117	122	227	232	237	242	247	352	357	362	367	372	477	482	487	492	497
103	108	113	118	123	228	233	238	243	248	353	358	363	368	373	478	483	488	493	498
104	109	114	119	124	229	234	239	244	249	354	359	364	369	374	479	484	489	494	499
105	110	115	120	125	230	235	240	245	250	355	360	365	370	375	480	485	490	495	500

Name _____

Address _____

City _____ State _____ Zip _____

BOOKS

73 Magazine, Pine Street, Peterborough, N.H. 03458

Please send me the following 73 products:

Qty.	Catalog #	Title	Unit Price	Total

Shipping and handling charges:
$1.50 1st book, $1.00 each additional book (UPS, use street address)
$10.00 each book overseas airmail

Shipping/handling _____

Total _____

Please allow 4-6 weeks for delivery.
No C.O.D. orders accepted.

Enclosed $_____ ☐ Check ☐ M.O.

Bill: ☐ AE ☐ MC ☐ Visa

Card # _____ Exp. date _____

Signature _____ Interbank # _____

Name _____

Address _____

City _____

State _____ Zip _____

NJ82

SUBSCRIPTION

73 Magazine P.O. Box 931 Farmingdale, N.Y. 11737

73 subscribers save 30% off the newsstand price.

☐ New subscription ☐ Renewal ☐ 1 year—$25

Enclosed $_____ ☐ Check ☐ M.O.

Bill: ☐ MC ☐ Visa ☐ AE ☐ me

Card # _____ Exp. date _____

Signature _____ Interbank # _____

Name _____

Address _____

City _____ State _____ Zip _____

Canada—$27, 1 year only, US funds.
Other foreign—$35, 1 year only, US funds.

322869

73
NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES
BUSINESS REPLY MAIL
FIRST CLASS PERMIT #20 P. O. BOX 326, DALTON MA 01226
POSTAGE WILL BE PAID BY ADDRESSEE
73 MAGAZINE
P.O. Box 326
Dalton, MA 01226-0326
NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES
BUSINESS REPLY CARD
POSTAGE WILL BE PAID BY ADDRESSEE
73 MAGAZINE
Subscription Dept.
POB 931
Farmingdale NY 11737
NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES
BUSINESS REPLY CARD
POSTAGE WILL BE PAID BY ADDRESSEE
73 MAGAZINE
Peterborough
NH 03458
Att. Mail Order

WHAT WILL YOUR NEW RIG BE LIKE?

Read 73 and Find Out

The magic of digital electronics is coming to ham gear . . . and you'll be able to read about these developments in *73*. There probably will be more changes in ham equipment in the next few years than ever before in history. You'll see these changes coming in *73*, where you'll read about the experiments and pioneering. *73* has more articles than any other ham magazine . . . often more than all the others combined.

When sideband got started, it was moved along by the many pioneering articles in *73*. In the 60s it was solid state, with several times as many articles on the subject than in all the other magazines combined. When repeaters and FM got going about ten years ago there were over five times as many articles on the subject published in *73* as in all other ham magazines combined . . . and you can see what changes that brought to hamming. Now we're looking at exciting developments such as narrow band sideband for repeaters . . . which might give us six times as many repeaters in our present bands. We're looking at automatic identification systems which may make it possible for us to read out the call letters of any station tuned in . . . and even the development of self-tuning receivers.

Will stereo double sideband techniques make it possible to have up to 30 times as many stations within a given HF band as is now possible? Hams will be experimenting and reporting on these developments in *73*. *73* is an encyclopedia of hamming . . . present and future . . . and just a bit of the past, too.

Without the endless fillers on station activities and club news, *73* is able to publish far more information . . . valuable information . . . on hamming and ham equipment.

You may or may not be a pioneer, but you certainly will want to keep up with what is happening and what the new rigs are going to be like. And, frankly, your support of *73* is needed to keep this type of information coming.

Yes, bill me for 1 year of 73 Magazine at $25.00

322B6

Name _____

Address _____

City _____ State _____ Zip _____

Canadian $27/1 year only, US funds. Foreign $35/1 year only, US funds
Please allow 4 to 6 weeks for delivery
73 Magazine • PO Box 931 • Farmingdale, NY 11737

16K Memory

4116-200ns **8/15.95**

ALL MERCHANDISE 100% GUARANTEED!

CALL US FOR VOLUME QUOTES

EPROMS

			Each	8 pcs
1702	256 x 8	(1ns)	4.95	4.50
2708	1024 x 8	(450ns)	2.99	2.75
2758	1024 x 8	(5V) (450ns)	9.95	8.95
TMS2516	2048 x 8	(5V) (450ns)	6.95	5.95
2716	2048 x 8	(5V) (450ns)	5.50	4.95
2716-1	2048 x 8	(5V) (350ns)	9.00	8.50
TMS2716	2048 x 8	(450ns)	9.95	8.95
TMS2532	4096 x 8	(5V) (450ns)	12.95	11.95
2732	4096 x 8	(5V) (450ns) (200ns)		CALL
2764	8192 x 8	(5V) (450ns)		CALL

DYNAMIC RAMS

				100 pcs
4027	4096 x 1	(250ns)	2.50	2.00
4116-120	16,384 x 1	(120ns)	8/29.95	CALL
4116-150	16,384 x 1	(150ns)	8/18.95	1.95
4116-200	16,384 x 1	(200ns)	8/15.95	1.80
4116-300	16,384 x 1	(300ns)	8/14.95	1.75
4164	64,536 x 1	(200ns)		CALL

STATIC RAMS

				100 pcs
2101	256 x 4	(450ns)	1.95	1.85
2102-1	1024 x 1	(450ns)	.89	.85
21L02-4	1024 x 1	(LP) (450ns)	1.29	1.15
21L02-2	1024 x 1	(LP) (250ns)	1.69	1.55
2111	256 x 4	(450ns)	2.99	2.49
2112	256 x 4	(450ns)	2.99	2.79
2114	1024 x 4	(450ns)	8/16.95	1.95
2114L-2	1024 x 4	(LP) (200ns)	8/19.95	2.35
2114L-3	1024 x 4	(LP) (300ns)	8/18.95	2.25
2114L-4	1024 x 4	(LP) (450ns)	8/17.95	2.10
2147	4096 x 1	(55ns)	9.95	CALL
TMS4044-4	4096 x 1	(450ns)	3.49	3.25
TMS4044-3	4096 x 1	(300ns)	3.99	3.75
TMS40L44-2	4096 x 1	(LP) (200ns)	4.49	4.25
TMM2016	2048 x 8	(200ns) (150ns)		CALL
HM6116	2048 x 8	(200ns) (150ns) (120ns)		CALL

LP = LOW POWER

CRYSTALS

32.768 KHZ	3.95
1.0 MHZ	4.95
1.8432	4.95
2.0	3.95
2.097152	3.95
2.4576	3.95
3.2768	3.95
3.579545	3.95
4.0	3.95
5.0	3.95
5.0688	3.95
5.185	3.95
5.7143	3.95
6.5536	3.95
8.0	3.95
10.0	3.95
14.31818	3.95
18.0	3.95
18.432	3.95
20.0	3.95
22.1184	3.95
32.0	3.95

January Specials

Z-80A-CPU	6.00
Z-80A-PIO	6.00
8214	2.95
8216	1.50
6800	4.95
6810	3.95

TMS 40L44-20
4096 x 1 low power 200ns RAMS

By Texas Instruments - not equivalent part number made by another manufacturer as sold by others:

4.49 each 125.00/32 pcs.

Specials end January 31, 1982

Please state "January Specials" when ordering

6502

6502	6.95
6502-A	12.95
6504	6.95
6505	8.95
6507	9.95
6520	4.35
6522	9.95
6532	14.95
6551	11.85

Z80

Z80-CPU	8.95
Z80A-CPU	6.00
Z80-P10	6.50
Z80A-P10	6.00
Z80-CTC	5.95
Z80A-CTC	8.65
Z80-DART	15.25
Z80A-DART	18.75
Z80-DMA	17.50
Z80A-DMA	27.50
Z80-S10/0	23.95
Z80A-S10/0	28.95
Z80-S10/1	23.95
Z80A-S10/1	28.95
Z80-S10/2	23.95
Z80A-S10/2	28.95
Z80-S10/09	17.95
Z80A-S10/9	22.95
Z80B-CPU	18.95
Z80B-CTC	17.95
Z80B-P10	17.95
Z8671	39.95
Z8132	34.95

MISC.

AY5-2376	12.50
11C90	13.95
XR2206	4.95
3242	7.95
3480	9.00
MC4024	3.95
MC4044	4.50
7103	9.50
7106	9.95
7107	12.95
76477	3.95
8038	3.95
95H90	7.99
9602	1.50

DISC CONTROLLERS

1771	24.95
1791	36.95
1793	44.95
1797	54.95

UARTS

AY3-1014	6.95
AY5-1013	3.95
TR1602	4.95
IM6402	7.95

INTERFACE

8T26	1.69
8T28	2.49
8T95	.99
8T96	.99
8T97	.99
8T98	.99
DM8131	2.95
DS8836	1.29

CLOCK CIRCUITS

MM5369	3.95
MM5375	3.95
MSM5832	7.45
7207	7.50
7208	15.95

CONVERTERS

MC1408 L8	4.95
DAC-0800	4.95
ADC-0804	4.95

800-538-5000
800-662-6279
(CALIFORNIA RESIDENTS)

CALL JDR BEFORE YOU BUY!
WE WILL BEAT ANY COMPETITORS' PRICES

74LS00 SERIES

74LS00	.25	74LS85	1.15	74LS166	2.40	74LS293	1.85
74LS01	.25	74LS86	.40	74LS169	1.75	74LS295	1.05
74LS02	.25	74LS90	.65	74LS170	1.75	74LS298	1.20
74LS03	.25	74LS91	.89	74LS173	.80	74LS324	1.75
74LS04	.25	74LS92	.70	74LS174	.95	74LS352	1.55
74LS05	.25	74LS93	.65	74LS175	.95	74LS353	1.55
74LS08	.35	74LS95	.85	74LS181	2.15	74LS363	1.35
74LS10	.25	74LS96	.95	74LS189	9.95	74LS364	1.95
74LS11	.35	74LS107	.40	74LS190	1.00	74LS365	.95
74LS12	.35	74LS109	.40	74LS191	1.00	74LS366	.95
74LS13	.45	74LS112	.45	74LS192	.85	74LS367	.70
74LS14	1.00	74LS113	.45	74LS193	.95	74LS368	.70
74LS15	.35	74LS114	.50	74LS194	1.00	74LS373	.99
74LS20	.25	74LS122	.45	74LS195	.95	74LS374	1.75
74LS21	.35	74LS123	.95	74LS196	.85	74LS377	1.45
74LS22	.25	74LS124	2.99	74LS197	.85	74LS378	1.18
74LS26	.35	74LS125	.95	74LS221	1.20	74LS379	1.35
74LS27	.35	74LS126	.85	74LS240	.99	74LS385	1.90
74LS28	.35	74LS132	.75	74LS241	.99	74LS386	.65
74LS30	.25	74LS136	.55	74LS242	1.85	74LS390	1.90
74LS32	.35	74LS137	.99	74LS243	1.85	74LS393	1.90
74LS33	.55	74LS138	.75	74LS244	.99	74LS395	1.65
74LS37	.55	74LS139	.75	74LS245	1.90	74LS399	1.70
74LS38	.35	74LS145	1.20	74LS247	.76	74LS424	2.95
74LS40	.35	74LS147	2.49	74LS248	1.25	74LS447	.37
74LS42	.55	74LS148	1.35	74LS249	.99	74LS490	1.95
74LS47	.75	74LS151	.75	74LS251	1.30	74LS668	1.69
74LS48	.75	74LS153	.75	74LS253	.85	74LS669	1.89
74LS49	.75	74LS154	2.35	74LS257	.85	74LS670	2.20
74LS51	.25	74LS155	1.15	74LS258	.85	74LS674	9.65
74LS54	.35	74LS156	.95	74LS259	2.85	74LS682	3.20
74LS55	.35	74LS157	.75	74LS260	.65	74LS683	2.30
74LS63	1.25	74LS158	.75	74LS266	.55	74LS684	2.40
74LS73	.40	74LS160	.90	74LS273	1.65	74LS685	2.40
74LS74	.45	74LS161	.95	74LS275	3.35	74LS688	2.40
74LS75	.50	74LS162	.95	74LS279	.55	74LS689	2.40
74LS76	.40	74LS163	.95	74LS280	1.98	81LS95	1.69
74LS78	.50	74LS164	.95	74LS283	1.00	81LS96	1.69
74LS83	.75	74LS165	.95	74LS290	1.25	81LS97	1.69
						81LS98	1.69

CMOS

74C00	.35	74C374	2.75	4019	.45	4098	2.49
74C02	.35	74C901	.80	4020	.95	4099	1.95
74C04	.35	74C902	.85	4021	.95	14409	12.95
74C08	.35	74C903	.85	4022	1.15	14410	12.95
74C10	.35	74C905	10.95	4023	.35	14411	11.95
74C14	1.50	74C906	.95	4024	.75	14412	12.95
74C20	.35	74C907	1.00	4025	.35	14419	4.95
74C30	.35	74C908	2.00	4026	1.85	4502	.95
74C32	.50	74C909	2.75	4027	.65	4503	.65
74C42	1.75	74C910	9.95	4028	.80	4508	1.95
74C48	2.10	74C911	10.00	4029	.95	4510	.95
74C73	.65	74C912	10.00	4030	.45	4511	.95
74C74	.85	74C914	1.95	4034	2.95	4512	.95
74C76	.80	74C915	2.00	4035	.85	4514	1.25
74C83	1.95	74C918	2.75	4040	.95	4515	2.25
74C85	1.95	74C920	17.95	4041	1.25	4516	1.55
74C86	.95	74C921	15.95	4042	.75	4518	1.25
74C89	4.50	74C922	5.95	4043	.85	4519	1.25
74C90	1.75	74C923	5.95	4044	.85	4520	1.25
74C93	1.75	74C925	6.75	4046	.95	4522	1.25
74C95	1.75	74C926	7.95	4047	.95	4526	1.25
74C107	1.00	74C927	7.95	4049	.55	4527	1.95
74C150	5.75	74C928	7.95	4050	.55	4528	1.25
74C151	2.25	74C929	19.95	4051	.95	4531	.95
74C154	3.25	74C930	19.95	4053	.95	4532	1.95
74C157	1.75	4000	.35	4060	1.45	4538	1.95
74C160	2.00	4001	.35	4066	.75	4539	1.95
74C161	2.00	4002	.25	4068	.40	4543	2.70
74C162	2.00	4006	.95	4069	.35	4555	.95
76C163	2.00	4007	.29	4070	.35	4556	.95
74C164	2.00	4008	.95	4071	.30	4581	1.95
74C165	2.00	4009	.45	4072	.30	4582	1.95
74C173	2.00	4010	.45	4073	.30	4584	.95
74C174	2.25	4011	.35	4075	.30	4585	.95
74C175	2.25	4012	.25	4076	.95	4702	12.95
74C192	2.25	4013	.45	4078	.30	4724	1.50
74C193	2.25	4014	.95	4081	.30	80C07	.95
74C195	2.25	4015	.95	4082	.30	80C95	.85
74C200	5.75	4016	.45	4085	.95	80C96	.95
74C221	2.25	4017	1.15	4086	.95	80C97	.95
74C373	2.75	4018	.95	4093	.95	80C98	1.20

HOURS: Mon. - Fri., 9 to 5; Sat., 11 to 3

VISIT OUR RETAIL STORE!

JDR MICRODEVICES, INC.
1224 So. Bascom Ave.
San Jose, CA 95128
800-538-5000 • 800-662-6279 (CA)
(408) 995-5430 • Telex 171-110

TERMS: For shipping include $2.00 for UPS ground, $3.00 for UPS Blue Label air. $10.00 minimum order. Bay Area residents add 6½% sales tax. California residents add 6% sales tax. We reserve the right to limit quantities and substitute manufacturer. Prices subject to change without notice. Send SASE for complete list.

2716 EPROMS 450NS (5V) 8/4.95 ea.

ALL MERCHANDISE 100% GUARANTEED! CALL US FOR VOLUME QUOTES

8000

8035	16.95
8039	19.95
8080A	3.95
8085	12.95
8085A-2	16.95
8086	99.95
8088	39.95
8155	11.95
8156	11.95
8185	29.95
8185-2	39.95
8741	39.95
8748	29.95
8755	44.95

8200

8202	45.00
8205	3.50
8212	1.85
8214	3.85
8216	1.80
8224	2.50
8226	1.80
8228	4.90
8237	19.95
8238	4.95
8239	4.85
8243	4.45
8250	14.95
8251	4.75
8253	9.25
8253-5	9.85
8255	4.75
8255-5	5.25
8257	8.75
8259	6.90
8272	39.95
8275	29.95
8279	9.50
8279-5	10.50
8282	6.65
8283	6.65
8284	5.70
8286	6.65
8287	6.50
8288	25.00
8289	49.95

6800

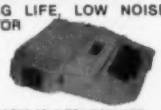
6800	5.70
6802	10.95
6808	9.95
6809	24.95
6809E	29.95
6810	4.60
6820	4.95
6821	4.95
6828	9.95
6834	16.95
6840	14.95
6843	42.95
6844	44.95
6845	16.95
6847	15.95
6850	4.75
6852	5.75
6860	10.95
6862	11.95
6875	6.95
6880	2.95
68B00	10.95
68B21	12.95
68B50	12.95

TV CIRCUITS

MC1330	1.89
MC1350	1.29
MC1358	1.79
LM380	1.29
LM386	1.50
LM565	.99
LM741	.29
LM1310	2.90
LM1800	2.99
LM1889	1.49

APPLE FAN $69.00

- EXTRA PLUG-IN CARDS CAN CAUSE YOUR APPLE TO OVERHEAT
- ULTRA-QUIET APPLE FAN DRAWS COOL AIR THROUGH YOUR COMPUTER
- ELIMINATES DOWN TIME
- SAVES REPAIR CHARGES
- INCREASES RELIABILITY
- CLIPS ON — NO HOLES OR SCREWS
- COLOR MATCHES APPLE
- LONG LIFE, LOW NOISE MOTOR



*APPLE IS A TRADEMARK OF APPLE COMPUTER INC.

IC SOCKETS

	1-99	100
8 pin ST	.13	.11
14 pin ST	.15	.12
16 pin ST	.17	.13
18 pin ST	.20	.18
20 pin ST	.29	.27
22 pin ST	.30	.27
24 pin ST	.30	.27
28 pin ST	.40	.32
40 pin ST	.49	.39

ST = SOLDERTAIL

8 pin WW	.59	.49
14 pin WW	.69	.52
16 pin WW	.69	.58
18 pin WW	.99	.90
20 pin WW	1.09	.98
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
40 pin WW	1.99	1.80

WW = WIREWRAP

CONNECTORS

RS232 MALE	3.25
RS232 FEMALE	3.75
RS232 HOOD	1.25
S-100 ST	3.95
S-100 WW	4.95

DIP SWITCHES

4 POSITION	.85
5 POSITION	.90
6 POSITION	.90
7 POSITION	.95
8 POSITION	.95

EPROM ERASERS

PE-14	78.50
PE-14T (with timer)	108.50
PE-24T (with timer)	154.50

ALL ARE HIGH QUALITY UNITS ENCLOSED IN A BLACK ANODIZED ALUMINUM ENCLOSURE.

OUR AD MAY BE IMITATED BUT OUR SERVICE CAN NEVER BE DUPLICATED.

TRANSISTORS

PN2222	10/1.00	100/ 8.99
2N2222	.25	50/10.99
2N2907	.25	50/10.99
2N3055	.79	10/ 6.99
2N3904	10/1.00	100/ 8.99
2N3906	10/1.00	100/ 8.99
1N4148 (1N914)		10/ 1.00
1N4004		25/ 1.00

VOLTAGE REG's

7805T	.79	7905T	.89
7808T	.99	7912T	.89
7812T	.79	7915T	1.19
7815T	.99	7924T	1.19
7824T	.99		
7805K	1.39	7905K	1.49
7812K	1.39	7912K	1.49
7815K	1.39	79LO5	.79
78LO5	.69	79L12	.79
78L12	.69	79L15	.79
78L15	.69		
		LM317K	3.95
LM309K	1.49	LM323K	4.95
LM317T	1.95	LM337K	3.95

T = TO-220 K = TO-3 L = TO-92

LINEAR

LM301V	.34
LM308V	.98
LM309K	1.49
LM311	.64
LM317T	1.95
LM317K	3.95
LM318	1.49
LM323K	4.95
LM324	.59
LM337K	3.95
LM339	.99
LM377	2.29
LM380	1.29
LM386V	1.50
LM555V	.39
LM556	.69
LM565	.99
LM566V	1.49
LM567V	1.29
LM723	.49
LM733	.98
LM741V	.29
LM747	.79
LM748V	.59
LM1310	2.90
MC1330V	1.89
MC1350V	1.29
MC1358	1.79
LM1414	1.59
LM1458V	.69
LM1488	.99
LM1489	.99
LM1800	2.99
LM1889	2.49
LM3900	.59
LM3909V	.98
LM3914	3.95
LM3915	3.95
LM3916	3.95
75451V	.39
75452V	.39
75453V	.39

LEDS

Jumbo Red	10/1.00
Jumbo Green	6/1.00
Jumbo Yellow	6/1.00
5082-7760 .43"CC	.79
MAN74 .3"CC	.99
MAN72 .3"CA	.99

74S00 SERIES

74S00	.44	74S74	.69	74S163	3.75	74S257	1.39
74S02	.48	74S85	2.39	74S168	4.65	74S258	1.49
74S03	.48	74S86	1.44	74S169	5.44	74S260	1.83
74S04	.79	74S112	1.59	74S174	1.09	74S274	19.95
74S05	.79	74S113	1.98	74S175	1.09	74S275	19.95
74S08	.48	74S114	1.50	74S181	4.47	74S280	2.90
74S09	.98	74S124	2.77	74S182	2.95	74S287	4.75
74S10	.69	74S132	1.24	74S188	3.95	74S288	4.45
74S11	.88	74S133	.98	74S189	14.95	74S289	6.98
74S15	.70	74S134	.69	74S194	2.95	74S301	6.95
74S20	.68	74S135	1.48	74S195	1.89	74S373	3.45
74S22	.98	74S138	1.08	74S196	4.90	74S374	3.45
74S30	.48	74S139	1.25	74S197	4.25	74S381	7.95
74S32	.98	74S140	1.45	74S201	14.95	74S387	5.75
74S37	1.87	74S151	1.19	74S225	8.95	74S412	2.98
74S38	1.68	74S153	1.19	74S240	3.98	74S471	9.95
74S40	.44	74S157	1.19	74S241	3.75	74S472	16.85
74S51	.78	74S158	1.45	74S244	3.98	74S474	17.85
74S64	.79	74S161	2.85	74S251	1.90	74S482	15.60
74S65	1.25	74S162	3.70	74S253	7.45	74S570	7.80
						74S571	7.80

7400 SERIES

7400	.19	7451	.23	74136	.50	74186	18.50
7401	.19	7453	.23	74141	.65	74190	1.15
7402	.19	7454	.23	74142	2.95	74191	1.15
7403	.19	7460	.23	74143	2.95	74192	.79
7404	.19	7470	.35	74144	2.95	74193	.79
7405	.22	7472	.29	74145	.60	74194	.85
7406	.22	7473	.34	74147	1.75	74195	.85
7407	.22	7474	.35	74148	1.20	74196	.79
7408	.24	7475	.49	74150	1.35	74197	.75
7409	.19	7476	.35	74151	.65	74198	1.35
7410	.19	7480	.59	74152	.65	74199	1.35
7411	.25	7481	1.10	74153	.55	74221	1.35
7412	.30	7482	.95	74154	1.40	74246	1.35
7413	.35	7483	.50	74155	.75	74247	1.25
7414	.55	7485	.65	74156	.65	74248	1.85
7416	.25	7486	.35	74157	.55	74249	1.95
7417	.25	7489	4.95	74159	1.65	74251	.75
7420	.19	7490	.35	74160	.85	74259	2.25
7421	.35	7491	.40	74161	.70	74265	1.35
7422	.29	7492	.50	74162	.85	74273	1.95
7423	.29	7493	.49	74163	.85	74276	1.25
7425	.29	7494	.65	74164	.85	74279	.75
7426	.29	7495	.55	74165	.85	74283	2.00
7427	.29	7496	.70	74166	1.00	74284	3.75
7428	.45	7497	2.75	74167	2.95	74285	3.75
7430	.19	74100	1.00	74170	1.65	74290	.95
7432	.29	74107	.30	74172	5.95	74293	.75
7433	.45	74109	.45	74173	.75	74298	.85
7437	.29	74110	.45	74174	.89	74351	2.25
7438	.29	74111	.55	74175	.89	74365	.65
7440	.19	74116	1.55	74176	.89	74366	.65
7442	.49	74120	1.20	74177	.75	74367	.65
7443	.65	74121	.29	74178	1.15	74368	.65
7444	.69	74122	.45	74179	1.75	74376	2.20
7445	.69	74123	.55	74180	.75	74390	1.75
7446	.59	74125	.45	74181	2.25	74393	1.35
7447	.69	74126	.45	74182	.75	74425	3.15
7448	.69	74128	.55	74184	2.00	74426	.85
7450	.19	74132	.45	74185	2.00	74490	2.55

HOURS: Mon. - Fri., 9 to 5; Sat. 11 to 3

master charge VISA

409

JDR MICRODEVICES, INC.
1224 S. Bascom Ave.
San Jose, CA 95128
800-538-5000 • 800-662-6279 (CA)
(408) 995-5430 • Telex 171-110

VISIT OUR RETAIL STORE!

TERMS: For shipping include $2.00 for UPS Ground, $3.00 for UPS Blue Label Air. $10.00 minimum order. Bay Area residents add 6½% sales tax. California residents add 6% sales tax. We reserve the right to limit quantities and substitute manufacturer. Prices subject to change without notice. Send SASE for complete list.

See List of Advertisers on page 114

REVIEW

KDK FM-2025A TWO-METER FM TRANSCEIVER

When you think about two-meter transceivers, what brand names come to mind first? Chances are, you'll name one of the big "full line" imported labels. There is nothing wrong with this except that you may be overlooking some of the other guys. What about firms like Azden and KDK? Both concentrate on selling a specific but high-quality line of radios. Until recently, I dismissed firms like these as "also-rans." Then I had a chance to review KDK's new FM-2025A two-meter FM transceiver. Now I'm a firm believer.

The FM-2025A is the latest in a series of two-meter mobile rigs that are manufactured by Kyokuto Denshi Company and imported into the United States under the KDK name. The 2025 represents a rather substantial departure from the earlier models, which included the 2015R, a great rig once you modified it. The staff at KDK has learned its lesson well; the FM-2025A offers many of the features that today's ham expects yet it remains simple and straightforward to operate.

Diode Matrix Programming

Like many of its modern day counterparts, the 2025A utilizes microprocessor control. In what seems like a step into the past, KDK has chosen to use a binary-coded-decimal diode (BCD) array to act as a program for the computer. Shades of the venerable Icom IC-22S. Or is it? Twenty-five diodes are used to program such functions as the low-frequency band edge, high-frequency band edge, transmit high-frequency band edge, a choice of 5-kHz or 12.5-kHz steps, the standard repeater offset, and band-scan step size. The unit comes factory programmed in a manner that will appeal to the vast majority of North American users. However, if you move overseas or have a need to operate outside of the US amateur allocation, it's a straightforward task to reprogram the KDK to meet your new needs.

If you are like me, most of your two-meter operating is done on a few local repeaters with occasional forays to other machines if you're traveling. Perhaps the easiest way to use the KDK is to program your favorite machines into the memories. There are two sets of memory, five channels each. You can use the channels independently or in a duplex mode where you receive on the "A" channel and transmit on the "B" selection. Since I frequent only a few repeaters, I find myself using the duplex mode. That way, I don't have to worry about switching the repeater offset selection when I change frequencies.

If you use more than five channels on a regular basis, then you may want to make full use of the ten memories by employing the offset switch for everything but the repeaters with oddball splits. The FM-2025A includes a nicad battery that provides internal backup for the memory when the radio is switched off. The infinitesimal 57-nano-ampere current drain allows the battery to last for as long as one year between charges.

Scanning

The FM-2025A offers two modes of scanning. You can search the ten memories for an open frequency or for a frequency in use. When the channel changes status, the receiver starts scanning again. If you want to lock the rig on frequency, just flip the scan control to the HOLD position.

The same options are available in the band-scan mode. The scanning starts with the frequency stored in memory A5 and proceeds upward to a limit determined by the contents of B5. But you can't fool the rig; if the B5 frequency is lower than the A5 selection, there will be no scanning.

The nice thing about the KDK's band scanning is its zero detector. This ensures that receiver scanning stops only on the center of a signal. The only difficulty I encountered came when I tried to scan near 144.000 MHz. An internal spur caused a false locking there.

One useful 2025A extra is a built-in tone switch. An internal switch allows you to select between a continuous tone or a half-second tone burst. There is no need to run out and buy a new encoder if your favorite machine goes private. There is easy access to adjustments for the tone generator's frequency and output level.

Procedures like this are explained well in the instruction manual. Unlike many manuals that accompany new gear, the KDK book is written with the assumption that the reader has some intelligence; it presents more than just an idiot's guide to installation. You'll even find four pages of technical and adjustment information plus a larger-than-usual schematic diagram.

The KDK's construction is nothing short of rugged. The vast majority of the rig's circuitry is on two boards, with the digital-based control circuitry on one and the rf blocks on the other. The lack of interconnecting wiring harnesses and cabling leads me to believe that the 2025A will easily withstand a harsh mobile environment.

The back panel includes a jack for an external speaker (and once you have tried this you will never settle for a built-in speaker again), antenna and power connectors plus an accessory connector that includes microphone input, audio output, transmit-receive switching, and connection to the 13-volt dc power supply.

Moving back inside, I noticed that all of the frequency generation and most of the audio circuitry was centered around integrated components. The rf section still utilizes a fair number of discrete semiconductors, but the chip-based technology is rapidly closing the gap.

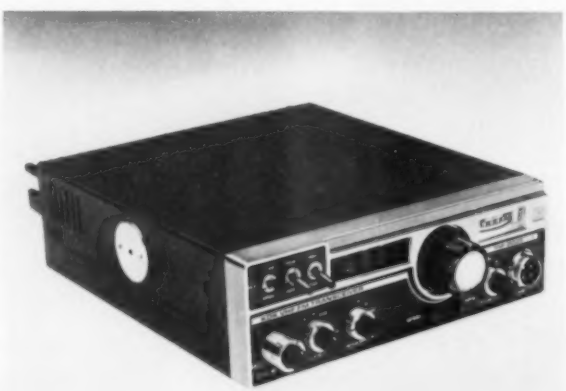
Plus and Minus Points

With a growing trend towards higher power for two-meter transceivers, the 2025A holds it own with a choice of two power levels, either one of which can be set between 3 and 25 Watts. If you need still more power, then consider an amplifier; you also get the added advantage of a receiver preamplifier that way. Unlike most of the other new FM rigs appearing on the market, KDK retains the traditional d'Arsonval meter movement for the power-out and signal-strength measuring chores. I can't knock the newfangled LED bar displays without trying them, but I do know that the old-fashioned meter makes the radio look more "professional."

Among the bells and whistles that you won't find on the 2025A is a priority channel. Nor is there a provision for up/down scanning via switches on the microphone. For me, the lack of these features had no effect on my operating style.

Perhaps the biggest drawback of this easy-to-use radio is the close proximity of the volume/squelch, mode, and memory-select knobs. They are all the same size and easily confused if you don't glance down at the rig.

On an overall basis, I give the FM-2025A high marks. It represents a substantial step forward in ease of operation.



The KDK VHF FM-2025A transceiver.

While it doesn't resemble the mission-control-panel look prevalent on a lot of new rigs, it is a sophisticated, feature-laden radio. It should be especially popular with amateurs who want a radio they can tinker with. The 2025A certainly proves that KDK is more than just the "other guys" when it comes to building radios.

In late 1981, the FM-2025A was priced at $299. For more information, contact *KDK Distributing Co., 617 South Gallatin Road, Madison TN 37115.* Reader service number 476.

Tim Daniel N8RK
***73 Magazine* Staff**

DFD SYSTEMS RT-89 RTTY SYSTEM

The DFD Systems RT-89 package is a disk-based RTTY system for Heath/Zenith H89 and H8/H19 computer systems. It runs under the Heath Disk Operating System (HDOS), providing unmatched features and flexibility for the serious RTTY enthusiast. The system is designed to operate on a single-drive, 48K machine with plenty of space left over for disk read/write files and memory buffer space. All input/output operations are buffered and interrupt driven, allowing true full duplex (send-while-receive) operation and real-time disk file read/write capabilities without loss of data.

There are 66 commands implemented to configure the system and control program operation. In addition, a special file, "RTTYINIT.TTY", is automatically read at program start-up time to establish the initial system environment. This file can be individually tailored by the user to automatically boot the system in any desired configuration.

RT-89 will operate at speeds of 60, 66, 75, and 100 wpm in the Baudot mode, or at any standard ASCII baud rate from 110 to 19,200. Automatic synchronous idle (diddle) may be selected at any of these speeds in either mode, and an automatic down-shift-on-space (DSOS) feature is selectable in the Baudot mode. All CW identification is automatic, including an ID at nine-minute intervals during any single transmission. This feature can be disabled with a keyboard command if desired. In addition, a CWID shift control and transmitter on/off control are available from the computer.

An automatic disk log is maintained each time the transmitter is keyed, and manual entries may also be inserted on the log at any time with the N= command. The time of day is automatically recorded with each log entry, so the system log can also be used as the station log if desired!

System line width can be varied from 20 to 80 characters since the H89/H19 terminal has a full 80x25 line display. The screen is split into four functional areas: a receive window, a transmit and command window, a split-screen and status-display bar, and a "times square" moving-marquee format on the 25th line that displays the transmitted data as it is actually transmitted. This latter feature is useful when the transmit buffer has been preloaded or a disk file is being transmitted, since the transmit window displayed the buffer contents as the transmit buffer was loaded, and the 25th line actually displays the buffer data as it is being sent. Therefore, the operator always "sees" what is being transmitted over the air at any given time. The sizes of the receive and transmit/command windows are dynamically variable and may be changed at any time during system operation. In fact, any commands may be issued at any time (except during transmit), so there is never a need to stop the program to reset any parameters as there is on some other systems.

The system may be directed to ignore carriage returns in the receive window, thus "packing" a maximum amount of data on the screen. The carriage returns are not ignored, however, on the printer or disk files, so the actual format of the received data is not lost (you can write on the printer, read and write on disk, and receive and transmit all at once, in real time, due to the interrupt-driven I/O structure).

Any number of files can be written to or read from disk at any time, and the printer may be turned on and off at will, independently for received and transmitted data!

A variable-length "word-correction buffer" is provided to allow correcting of keyed input data prior to its release to the system. The length of this buffer may be set from 1 to 80 characters, and facilitates backspacing over entry errors and correcting them before transmission. There are actually two cursors displayed on the screen: a flashing underline cursor which indicates where the word correction buffer starts, and a destructive block cursor indicating the next location that will be occupied by keyed input. In addition, the system can be directed to automatically "wrap around" when the end of a line is reached and no carriage return is keyed. In this event, the system will automatically move the last word keyed to the next line, if it is incomplete, and issue the carriage return itself.

An unusual and very enjoyable feature provides the ability to process RTTY pictures. The system may be placed in the PIX mode, and overlining will be allowed on input and output files and the printer. In addition, three off-line programs are included with the package that will allow one to edit PIX files with the standard HDOS text editor, and automatically compress and expand those PIX files to conserve disk space. PIX files received over the air are actually compressed before they are written to disk, and compressed PIX files on disk that are read for transmission are automatically expanded by the system at transmit time!

In addition to the unlimited disk file capability, there are three temporary single-line buffers that can be loaded and read out using the three colored function keys on the H89/H19 keyboard. These are handy for holding calls of current stations in QSO or repetitive contest information. Other function keys can be used to insert the current date and/or time in the transmit buffer. (The time of day is also always maintained on the split-screen bar.)

In operation, the TX or TXF commands will put the system in transmit mode, and a CONTROL-C will terminate the transmit mode. Data can be entered into the transmit buffer while in receive mode, and that data will be transmitted the next time TX (transmit) mode is entered. TXF (transmit fast), on the other hand, will not send the data in the transmit buffer, but will only send data keyed from the keyboard. TXF, therefore, is used to answer a quick question or to send a quick message without sending the data in the transmit buffer. After TXF, more data can be entered into the transmit buffer, if desired.

Disk-based commands include opening and closing disk files for either read or write, displaying directories, deleting files, exchanging files, and swapping disks in drives 1 and 2.

Performance

The RT-89 system has performed very well for more than a year of operation on both the HF and VHF bands. The system was designed to support Navy MARS message traffic as well as amateur traffic, and has now replaced all mechanical teletype equipment at Navy MARS stations NNN0AFL and NNN0ZVW. No system problems or failures have yet been encountered at either station.

The system includes complete operational documentation and directions for interfacing the computer to a terminal unit. The system has been successfully interfaced with a HAL ST-6, commercial and homebrew Flesher TU-170s, and the iRL-500. The iRL-500 interface was the easiest to accomplish since it already had inputs and outputs to directly interface to the computer at RS-232 voltage levels.

Each RT-89 system is personally generated for each purchaser to include the station callsign. This callsign is permanently displayed on the split-screen bar during system operation and is used in generating the CW identification. Minimum hardware requirements are an H8 (with an H19 terminal) or H89 computer, a single disk drive, and 48K memory. HDOS is also required to operate the system. The package consists of the programs on a 5¼" diskette and an instruction manual. The cost is $39.95. For further information, contact *DFD Systems, 4805 N. 107th Street, Omaha NE 68134.* Reader Service number 477.

Dick Jugel K0DG
8014 Taylor Circle
Omaha NE

INTERFERENCE HANDBOOK

Whether the alphabet-soup nomenclature is TVI, RFI, or EMI, interference is a constant threat to the radio amateur, lurking in the shadows, waiting to

turn docile neighbors into a horde of angry enemies. Even though the war against interference has just begun, there is hope for the ham-radio army. Radio Publications' new book, *Interference Handbook*, is destined to become a bible for the tactics-minded foot soldier. The author of *Interference Handbook* knows what he is talking about; William Nelson WA6FQG is the veteran of sixteen years of trench warfare as an RFI investigator for Southern California Edison Company.

RFI has plagued us ever since Marconi made his first transmissions nearly a century ago. While modern-day legislators and manufacturers grapple over a long-term solution, the problem gets worse and the poor radio amateur is caught in the middle. The approach that *Interference Handbook* takes is best summarized by the quote: "The purpose of this handbook is to outline the many sources of interference; explain how to eliminate or reduce them; and tell you how to protect yourself against RFI. The causes and cures of RFI are discussed in nontechnical language that is easy to read and understand."

The topics discussed range from interference caused by home appliances and the RFI emitted by power lines to the misunderstood role that hams and CBers play in causing and solving interference problems. Along the way, the author gives case histories based on his years as an investigator.

Tips for locating interference with inexpensive gear are accompanied by descriptions of commercial and homemade cures. The contents will be of interest to anyone who deals with electronics. This could include the members of a radio club interference committee or a music lover who is plagued with automobile ignition noise. The book is rounded out with a listing of addresses for gaining help from manufacturers.

Interference can work both ways as evidenced by recent experiences at the *73 Magazine* ham shack. Several months ago, a pulsating noise of unknown origin kept us bewildered (and off the air) for several weeks. More recently, a neighbor has complained about TVI that may be the result of our station. In both of these cases, a volume like the 247-page *Interference Handbook* would have helped to reduce the mystery and aggravation for everyone involved.

A paperback edition of *Interference Handbook* is available from the publisher, *Radio Publications, Box 149, Wilton CT 06897*, or *73's Radio Bookshop, Peterborough NH 03458.*

Tim Daniel N8RK
***73 Magazine* Staff**

LETTERS

QRZ CONTEST?

The weekend is here, I can't wait to get my cup of coffee, go downstairs and turn on the rig, and relax with some CW. Cranked up the old workhorse, my TR4-C, switched on the keyer. I love CW, my phase of enjoying ham radio, and spend most of the time on 20 meters and a little on 40 meters.

Here comes the audio, and what? Not again! The entire band loaded! Another contest? I thought they just finished one; you know how time flies. I must admit I have been in only one contest, in the early 60s, and cannot remember what it was for, but learned it was not for me. There are no redeeming factors in them that I can see. A field day or emergency preparedness operation so as to be able to get a station on the air fast in almost any location, portable, of course, to assist those in need of help, I am all for without exception, but to sit for 12 or 24 hours at a key or a microphone causing a traffic jam worse than the California freeways ever saw is a gross waste of time and energy.

I enjoy a good rag chew—or at least to find out more than a QTH and a name that's in the *Callbook*—talking over your experiences, experiments, good or bad, is a greater way to enjoy one's on-air time.

Let's think about it; contest weekend as it appears to me seems to relate itself to the opening of hunting season, the night before everyone participating making final preparations, checking their "guns" for the big day. From cannons to peashooters they are all ready. The clock is ticking away the last few minutes before the action begins. The beams are poised at each other, power supplies humming away, fingers begin twitching, one ready to send, one ready to record the contacts, then bang! A solid wall of rf rips through the ether and for the next day the battle for the climb to the top rages on. Stepping on each other, over, under, and around. When the period of time for the contest is over and the electromagnetic radiations clear, the battlefiled can be seen strewn with broken and mangled coffee cups, smoking ballpoint pens, splinters of pencils, and scraps of paper. The casualties are entering the "hospitals" with keyer finger, tennis wrist, another form of keyer finger, and ear-ring: a new one, being a depression in a circular fashion around both ears, manifested by a constant series of tone bursts that won't subside.

Why so many contests? Aren't there enough awards to be gotten on one's own without the additional promotion of contest after contest? I would like someone to reply and let me know.

Now don't get me wrong. I have gotten a few of those symptoms myself. What I am trying to say is those who prefer contests are good hams, they enjoy their phase of ham radio, a great hobby filled with very nice people. But all I ask for us in the apparent minority is that on those special weekends, those who sanction such contests *think*, think of the other hams who are not participating and leave at least 10 or 15 kHz aside for those of us who would like to just get on and relax with a good QSO, be it CW or SSB.

Why should the bands be totally monopolized during these periods? A lot of us just do not have the time to spend on the bands and really look forward to our weekend operation.

Gary L. Jackson N2ACX
Delron NJ

N2ACX UR 599 NH DE WB8BTH BK.

THANK YOU, ERIC

As a subscriber, I feel it is my duty to inform you of the good job you are doing. I am a new subscriber to your magazine and I love it! I am 13 years old and a General class ham. My father is also a ham and he likes your magazine, too. Between my father and I we receive *QST, Ham Radio, CQ, 73,* and *CVRA-SERA Journal.* We enjoy your magazine the best. The $25 is well worth it. I find many interesting articles in your magazine. In *QST, Ham Radio,* and *CQ* I rarely find a really good article. Many times the advertisements are the best things in *QST*! I can't say *QST* is a bad magazine—it has many important references. The other magazine (journal), *CVRA-SERA Journal,* is a great magazine. I find it and *73* the most interesting.

Thank you for your time. I just wanted to tell you how great your magazine is. Keep up the good work!

Eric Lassiter KA4KEG
Danville VA

WIN SOME, LOSE SOME

The last of the ham radio publishers bit the dust! I never thought you would pass us off for the quack electronics, but my new December issue with satellite TV, computer scanners, and all really opened the old eyes. I think I'll go back to model trains. I get enough of the electronic garbage at work all day. NO renewal for me next spring.

Ed Chenoweth K4HYG
Zephyrhills FL

Sorry to lose you, Ed, but we do have to bring news of what is happening in electronics to those amateurs who are helping the hobby to grow. . . who are interested in things beyond spark gaps. I realize that not all hams are going to be inventing and pioneering new techniques, but

I had hoped that those who are more interested in taking a free ride on the shoulders of those who are doing the work would at least be honorable enough to read about it and cheer them on instead of trying to shoot them down.—Wayne.

KNIT PICKING

Seldom do I write to the editor of a magazine, but every once in a while something will catch my eye. Such was the case when you asked in the October *73 Magazine* what we could do to spur the growth of ham radio.

Let me state that I am flatly opposed to no-code licenses. We already have them in the form of citizens band communications (I use the word "communications" with some reservation in this case), and I for one don't want 15-meter phone sounding like that. I really can't imagine that you do either.

Now to the basic question: What can we do?

1. We can exert pressure on the Federal Communications Commission through our elected representatives to take the tricks out of amateur exams. For example, a friend recently took (and passed) the Extra class examination in Boston. Part of his code proficiency test involved the apparent word "Springfield," but on the tape it was sent "Cpringfield." Granted, this quickie will determine if the examinee is paying absolute attention, but does it prove anything else? Is this the type of thing one would encounter in a normal QSO (which the tape is supposed to emulate)? I think not.

2. We can stop regarding ourselves as an elitist group. While my previous reference to citizens band could be construed as elitist—and perhaps it is—we must recognize that our hobby is no better than that of anyone else. If a CBer wants to be a CBer, then so be it. If an audiophile gets enjoyment from his "thing" then let him. We should not continue with the attitude that everyone in electronics either should "progress" into the ham fraternity or be relegated to second class. Perhaps if we are less pushy more people would *want* to join us.

3. Along the same lines, we should make more of an effort to help the newcomer. We spend a lot of time and effort getting people into ham radio through Novice classes, but how many Novices have given up on our hobby because the Techs, Generals, Advanceds, and Extras were too busy with their own interests to give a hand *after* the newcomer got that much-anticipated ticket? If you're not really sure of what you're doing and there's no one to help, amateur radio can be pretty confusing. Take the time to help a Novice; you may be saving tomorrow's Extra class licensee.

4. Again, along the elitist line, we need to have more of those "in the know" willing to make what they know readily available. It does not seem consistent to this writer that an editor of a widely-read ham publication could advocate the spread of our hobby on the one hand and then ask $1,000 or more for a speaking engagement at a hamfest on the other. Granted, Dayton and Birmingham can probably afford this tariff, but Windsor (our local hamfest) can't, and Windsor is more likely to touch a greater number of new and prospective hams in central Maine than are Dayton and Birmingham combined. Please don't take this as a personal attack, Wayne, but you *did* ask for constructive ideas.

5. We need more affordable equipment designed for beginning amateurs. Unfortunately, our hobby is pricing itself out of the reach of many would-be joiners because they can't afford a Kenwood TS-530, an Icom 720A, or an Astro 150. What we need are more Ten-Tec Century 21s that let the little guy get his feet wet with new (a Novice doesn't need the problems which often come with used gear), reasonably priced, and effective equipment.

6. Finally—for now, at least—we need effective representation in the FCC. Some government commissions are required to reflect in their membership the interests of those that they regulate. Why not a ham as a required commissioner, and a CBer, too? Who knows better what we want than one of our own? Certainly not some politician from the "in" party who had the misfortune of losing in the last election.

Well, Wayne, there you have it. I hope this letter will prompt others to put on their thinking caps and come up with more and different ideas. I wouldn't even object if theirs were better.

Bill Crowley K1NIT
Hallowell ME

No offense, Bill; the $1,000 goes for a special fund for promoting amateur radio, not into the general coffers. Without that limitation I've found that I am getting dozens of invitations to talk... few of which would be possible for me. Thus, this is a filter... and also a benefit for amateur radio. You're right about the tricky exams... there is no excuse for them. There will be cheaper ham gear for beginners when we have enough beginners to make it profitable to make the stuff. Remember that plenty of equipment has been put on the market in the past, but it has not been continued due to an almost total lack of newcomers. And look what happened to the newcomer magazine, Ham Horizons!*—Wayne.*

THE HEATH SNOOZE

I have just finished the conversion of my Heathkit clock as stated in the November issue of *73 Magazine* ("Extra Accuracy for Heathkit Clocks," page 124).

There were no conversion or cross-reference lists at any of the local Radio Shack stores for a switch with part number 275-430. I could have used another RS switch, but keeping with amateur radio practice I quickly realized that the Alarm Set Switch (SW3) could be used and the old Snooze Alarm Switch (SW2) wired in its place. It is a little cumbersome to use in setting the alarm, but then I don't use this function. My clock works as stated in the article.

The wiring is done in the same manner as Art N5AEN stated, and the new SW3 is wired as shown in the clock manual.

Others may be interested in this miser's scheme to beat down the rising cost of ham radio.

I've enjoyed *73 Magazine* and will continue to do so.

Jack Garner KB7HH
Phoenix AZ

THE BIG ZAP

When I read *QST*, I first look at the silent keys. With your *73*, I read the editorial. I was especially interested in the radar devices you use and test. My mobile friends tell me the devices are not very good anymore. The policeman with the gun pops it on and gets a reading and you are hooked. No more carrier to seek out. I don't travel much anymore, but I do have a new approach to traffic tickets.

I propose a tape-deck player and a specially-prepared deck that starts with fifteen seconds of soft music, and then a convincing commercial announcer who breaks in with the news that the USA is being attacked by USSR missiles and the President is on his way by helicopter to the Virginia underground shelter... all citizens are to go to any nearby shelter. News flashes give reports of missiles twenty minutes from Chicago, Detroit, Washington...

I think by this time the trooper is on his way and you are free to go to your destination.

Just don't get stopped by the same guy the second time.

Ed Kirchhuber K4JK
Elkmont AL

Fiendish... I like it! The radar gun? I've only run into one once in New Hampshire so far, so it isn't much of a problem here. In that case, I got plenty of warning before I even got close due to the sensitivity of the superhet detector and was safely not transmitting on two meters when I went through the check point. Your detector should pick it up a half-mile to a mile away and give you plenty of warning to stop transmitting so you won't rack up a speeding ticket even when you are moseying along at 55 per. The officer generally takes a shot at a car ahead of you and you pick up that blast. This also gives you a chance to check your speed... which averages around 70 mph on most of our interstates.—Wayne.

GUS TRAVELS AGAIN

Those of you who have been around ham radio for more than a few years undoubtedly remember Gus Browning's fabulous DXpeditions of the 50s and early 60s. Well, W4BPD is back at it again and will be sending us monthly reports on the progress of his current round-the-world trip. Welcome aboard 73, Gus!

This little episode is being written while we are at anchor down in Florida awaiting a few minor repairs to be completed on the boat, but by the time you read it we will be somewhere in the Caribbean. We have named the ship *DX* since DX is what it's all about with us. Our mail address from now until this trip is completed is just "DX, 29039, USA."

A friend of mine talked with me up at DXPO 80 last September and asked me the question, "Have you ever thought about another DXpedition, Gus?"

You know what my answer was ("I have the time if you have the money"), and he said that money was no problem! It ended up that a boat was purchased and the old rat race of getting it shipshape for a real DXpedition began. The result is that here we are about to take off for the *complete* Caribbean tour; we'll go to every country down there that we can get permission to operate from. (They tell me that licensing is no problem at almost every one of them.)

This feller Wayne Green must have lots of pull somewhere because both on our way from Annapolis to Beaufort, South Carolina, and then again from Beaufort down here, I saw a sign on the Inland Waterway on the left side each time with the numbers 73 on a *green* background. And this Wayne Green don't fool around, neither, because when I mentioned writing a series of letters for *73 Magazine*, he said, "Don't stand there, start writing." So here I am doing just that.

This DXpedition should be considerably different from the others I have been on. This is planned to be an island-hopping DXpedition with inland excursions when it's possible and worthwhile from a DX viewpoint. We will be going by the seat of our pants all the way. This DXpedition by boat sure will be a lot better than the other ways I have used before, and it sure will be lots cheaper to charter a ship than to spend anywhere from $100 on up per day the way I've done it many times before. Since 99% of our traveling will be sailing, using the wind for power, it will be very interesting to see how our overall expenses compare with those of trips when other means of transportation were used.

The purpose of the first portion of this trip will be twofold: We will be shaking down the boat and we will be trying to see how we get along with each other being cooped up over long periods of time in a small space. There are three of us—myself, my XYL, Peggy, and Sam, a WA3 from the Washington DC area who purchased the boat. So far we are quite compatible, though at times a little touchy with each other, which we all expected before we ever got started.

Our tentative plans are to cover the Caribbean, probably taking until the next hurricane season, which starts next June. Then we will sail back to Beaufort to have the boat gone over with a fine-tooth comb and to visit all the grandchildren, the kids, and our friends. We'll restock the boat's larder, tighten up all the bolts and nuts, and then take off for the Panama Canal, the big, wide Pacific, and all those countries out there waiting for us to Dxpedite. If things are still "go," then we will continue on around the world, hitting as many spots as we can along our line of travel. We won't mind deviating from this line of travel a few hundred miles when, from a DX viewpoint, it looks like that's what we should do.

The very first thing we all agreed upon was that we wanted this trip to be a safe one. Since we have no set date to be anywhere along our route, we can always wait for the weather to get right before we depart from spot A to go to spot B. If all three of us like a certain place and want to spend a few more days or even weeks there, we will do just that. This will more or less be a leisure trip with DXpeditioning a first priority on our list. Right now, we are at the creeping stage; we hope to be at the walking stage when I write the next installment, and at the running stage from there on out.

We have a very good ship, an O'Day 37 (measuring 37 feet long and 11 feet across). How would you like to make something like this your complete home for up to five years? It will be on the rough side, but we will be in there trying our best to stick it out. Our ship is fully equipped with all the very latest gear. We have a satellite navigator that does a better job of pinpointing our position than most maps. We have a good radio direction finder, a good VHF transceiver, and, of course, a sextant, which I have practiced on for months. I still need more practice to get good on it. We have a huge pile of maps and charts but will need many more when we get to the Pacific and other oceans on our way around the world.

We will be taking it easy along the way and hamming as much as possible. We plan to use both CW and SSB on equal terms, going by the apparent needs of the fellows. We have the full Ten-Tec line of gear, their Omni-C, Hercules linear, electronic keyer, and antenna tuner for the long wires we may put up for the low bands. I cannot get over the Ten-Tec's fast break-in, the no tuning when you change bands, and the almost silent receiver when you disconnect the antenna. As a back-up, we have Ten-Tec's Delta. Our antenna is a TET and it will get a real test of endurance on this trip. As you can see, we're delighted with the equipment we have.

QSLs will go out three different ways. When we have time after the trip, every QSO in the logs will go out via bureaus. The second way of QSLing will be direct to those who send their cards to out "DX 29039 USA" headquarters and contribute $1.00 to help us defray the cost of QSLs, postage, and Girl Friday making them out. The third method will be direct from the spot where we work you or, if necessary, from the next spot we operate, to those making a $2.00 contribution to help us with expenses. (We do not expect to come anywhere near breaking even on our expenses.)

I don't think we can help anyone with 300 or more countries, but we might be able to help you if you have 200 or so. Maybe we will help some of you on 40, 80, or 160 meters. Later on we may use other means and ways of communications. We are, of course, open to your suggestions. We may or may not follow them, but "try us"—hi.

On CW, look for us 25 kHz from the low end, except on 160, 80, and maybe even 40. On SSB, when we are not under FCC rules, we will try using more or less these frequencies: 28490, 21190, 14105, 7090, 3790 kHz; and on 160—who knows, hi. But once we settle down on the frequencies we want to use, these will be where we will always be found, plus or minus QRM. I can promise you I will never get mad at anyone on the entire trip. A real nuisance to us may have a difficult job getting our QSL for his contact—the last laugh will be us doing the laughing, hi.

Up to now, there has been very little contributing or donating by anyone, so I am under obligation to just a few and I know who they are. I don't mind tail-enders or any other way you can come up with to get your call in my log. I try to work the weak ones first, so if you are QRO please go QRP if you want to work us first, hi. At times we will QSY into the Novice bands and will usually be tuning in the parts of the band Generals can use. But you had better have wide shift-split capabilities, or you may miss us. Occasionally, we will use transceive, but don't depend on this mode for many contacts with us. I say get yourself an outboard vfo and join in with the real DXers.

There will not be any of this list type of stuff on this DXpedition—if you want to QSO, get in there and work me. I don't want any of this stuff: "Gus, so and so said you are Q5-S7"; I want to hear that report and call myself without any assistance from helpers on the sidelines.

That's it for this episode, fellows—73 de Gus BPD.

Gus Browning W4BPD

HAM HELP

I am in need of technical information for the RCA AR88D receiver. I am also looking for a 24-hour brass ship's clock.

Mickey McDaniel W6FGE
940 Temple St.
San Diego CA 92106

I am searching for information on the use of electric limit switches with a Triasto TX-455 crank-up tower.

Don Greenwood KC8GZ
2687 Timothy Place
Wooster OH 44691

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

HAMS AND COMPUTERS

Shh! Keep this quiet! Don't tell anyone, but I think microcomputers are taking over amateur radio.

Take last Friday, for instance. I'm working this station on CW—AF2M, I think the call was—and he's telling me about his rig, the weather, and all those other things that make QSOs so interesting. Then, all of a sudden, something must have blown in his shack because he just keeps sending "599, 599, 599. . ." After about 10 minutes of having my signal verified, it dawns on me—AF2M is a machine! Egad! This is worse than CB. At least on the chicken band you pick up animals, not androids.

It's scary. So scary, in fact, that I decided to write a column about ham radio and microcomputers. Here it is but don't tell anyone. I hate to be an alarmist. Where the heck did I put my nightlight?

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1 Letters and numerals
8 Below high frequency (abbr.)
9 Direct memory access (abbr.)
10 Computer lingo
13 Package type (abbr.)
15 Operating position
18 ____ line
19 Former big-time computer manufacturer (abbr.)
20 Program that revises (2 words)
22 And off
23 Data processing (abbr.)
25 Bulletin board (abbr.)
27 Semiconductor type (abbr.)
29 GOSUB

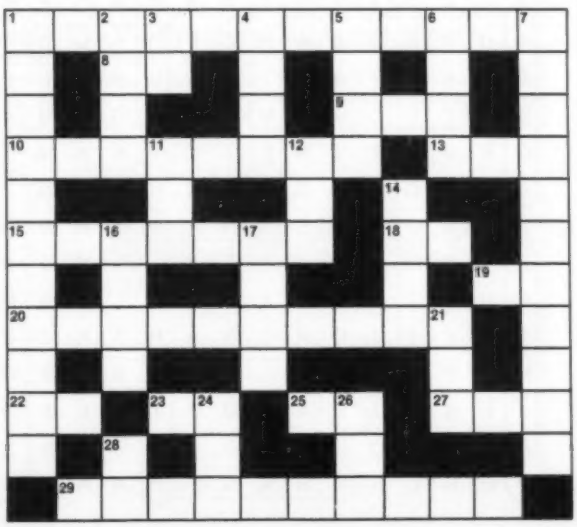


Illustration 1.

Down

1 Computer use
2 Scheme
3 Below VHF (abbr.)
4 They bought micro for shuttle (abbr.)
5 Statement of condition
6 "Only" type of memory
7 User
11 Crummy software often runs out of this
12 Golly
14 Instruction
16 To follow immediately
17 Bright diodes (abbr.)
21 Memory type (abbr.)
24 Cycles in a second
26 Smallest computer unit
28 μ

ELEMENT 2—MULTIPLE CHOICE

1) Computers can exchange information by using a code known as ASCII. What does this acronym stand for?
   1. American Standard Code for Interchanging Information
   2. American Standard Code for Information Interchange
   3. American Standard Code for Interconnecting Information
   4. American Standard Code II

2) Who was Herman Hollerith?
   1. Father of the punch card
   2. Father of punched paper tape
   3. Inventor of the floppy disk
   4. Inventor of the CRT

3) What are "Napier's Bones"?
   1. The remains of August Napier, inventor of the first analog computer
   2. The first pocket calculator, named for the device's ivory color
   3. A figment of the imagination
   4. Ivory rods which, when placed next to each other, can be used for multiplication calculations

4) An "automaton" is:
   1. A mechanism under the constant control of its own resident intelligence
   2. A mechanism under the constant control of a human or other external intelligence
   3. A mechanism under the constant control of a programming routine previously supplied by an external intelligence
   4. A waste of time

5) How many laws of robotics did Isaac Asimov detail in his book *I, Robot*?
   1. One 2. Two 3. Three 4. Four

ELEMENT 3—TRUE-FALSE

	True	False
1) HAL, the computer in *2001: A Space Odyssey*, was built at the Hal Plant in Urbana, Illinois, on January 12, 1997.	_____	_____
2) Speaking of HAL, his name stood for Heuristically-programmed ALgorithmic computer.	_____	_____
3) The word "robot" was coined by Czechoslovakian author Karel Capek in his play *R.U.R.*	_____	_____
4) An early electronic computer, ENIAC (1946), contained 19,000 vacuum tubes.	_____	_____
5) After ENIAC, there was a computer called MANIAC.	_____	_____
6) PASCAL, the computer language, was named after Blaise Pascal, a 17th century French philosopher.	_____	_____
7) The "Computerist's Code" states that a computer user should never use his equipment to harm anyone.	_____	_____

8) BASIC is a high-level language. _____ _____
9) Bubble memory uses microscopic magnetic bubbles. _____ _____
10) CPU stands for "Control Programming Unit." _____ _____

ELEMENT 4—HIDDEN WORDS
(Illustration 2)

Hidden in this puzzle are words representing 15 different computer terms. The words are formed in any direction—horizontally, vertically, or diagonally, forwards or backwards. As you find each word, circle it.

G	W	Z	M	A	T	R	L	O	A	D	E	P	T	I
A	I	A	R	I	A	D	A	B	A	E	A	O	A	S
R	D	I	B	R	L	W	N	C	I	B	A	U	D	R
B	D	A	A	Y	A	X	I	H	N	U	C	E	L	E
A	I	Y	R	O	M	E	M	F	E	G	G	N	U	A
G	E	R	A	P	B	N	R	I	C	V	S	A	M	T
E	A	R	C	I	S	T	E	E	D	K	G	T	N	T
J	O	B	O	O	T	S	T	R	A	P	T	H	D	R
R	W	D	M	U	N	A	R	E	A	A	G	R	I	A
E	H	S	P	I	D	P	X	S	G	T	L	V	A	H
T	H	I	I	J	E	R	C	S	A	R	Y	E	S	C
N	N	O	L	T	N	A	D	D	R	E	S	S	K	W
I	E	S	E	J	L	A	D	D	P	T	N	E	E	O
R	D	G	R	O	E	F	S	G	S	Y	D	O	N	L
P	W	R	E	H	Y	R	A	N	I	B	A	R	R	F

Illustration 2.

A	L	P	H	A	N	U	M	E	R	I	C
P		L	F		A		O		E		O
P		A			S		D	M	A		M
L	A	N	G	U	A	G	E		D	I	P
I			A			E		G			U
C	O	N	S	O	L	E		O	N		T
A		E			E			T		G	E
T	E	X	T	E	D	I	T	O	R		R
I		T			S				A		I
O	N		D	P		B	B		M	O	S
N		M		E			I				T
	S	U	B	R	O	U	T	I	N	E	

Illustration 1A.

READER'S CORNER

Do you have a ham-related puzzle you would like to share with FUN's readers? Then send it in for a chance to see your name in print. This month's contribution is by Joe Strolin K1REC, of Norwalk, Connecticut.

MAGIC SQUARE
(Illustration 3)

Circle any number, then cross out all numbers in the same row and column. Do this until only one number is left, to get the message.

Send in your answers. We'll print the name and call of everyone who solved the puzzle.

14	15	13	16
13	14	12	15
21	22	20	23
23	24	22	25

Illustration 3.

THE ANSWERS

Element 1:
See Illustration 1A.
Element 2:
1)—2. And you know what great stuff American Standard makes.
2)—1. Ever noticed how these cards are only a little larger than a dollar bill? That's because HH used the dollar bill of his time (1890) as the template for his card. He invented the card and its reader for use in the US census.
3)—4. Scottish inventor John Napier (1550-1617) developed this precursor to the slide rule.

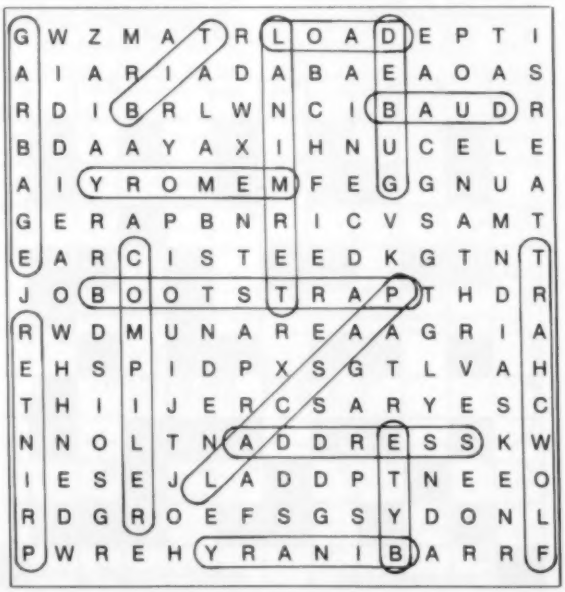


Illustration 2A.

4)—3. 1 is an android, 2 is a robot, and 4 is what noting the differences is.
5)—3. And if you break one of the three, you'll get a robot fine.

Element 3:
1)—True Long way from the ST-5000, Dr. Chandra.
2)—True Try saying that 10 times, fast.
3)—True Rossum's Universal Robots.
4)—False Ha-ha; slightly under 18,000.
5)—True Engineers just love snappy acronyms.
6)—True Blaise Pascal (1623-1662), who, after a day of philosophizing, would tinker with his adding machine.
7)—False The computerist's what?
8)—True Also the most popular, as if you didn't know.
9)—True And if you look through a microscope, you can even see them move.
10)—False Central Processing Unit.

Element 4:
See Illustration 2A.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or ½ point for each question correctly answered.

Element 2:
Five points for each correct answer.

Element 3:
Two and 1/2 points for each correct answer.

Element 4:
Two points for each word found.

Are you digitally inclined?
1-20 points—Still mad at the government for outlawing spark.
21-40 points—Thinks computers might have a future.
41-60 points—Likes to play with display computers in stores.
61-80 points—Owns a nice, sensible computer system.
81-100+ points—Home-brews own computer.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

WAT AWARD

The Cabin Fever Radio Club of Tok, Alaska, offers a certificate for contacting three amateurs in Tok. There are no band or mode restrictions. However, all contacts must be made after December 15, 1980, to be considered valid.

To apply, prepare a list of contacts in order by callsign. Include the name of the station operator, the date and time worked in GMT, and the mode and band of operation. QSLs not required. Amateurs located in Tok include AL7O, AL7BO, AL7BV, and WL7APG.

Send your application with $2.00 or 10 IRCs to: Cabin Fever Radio Club, Box 451, Tok AK 99780.

WORKED ALL FORGOTTONIA

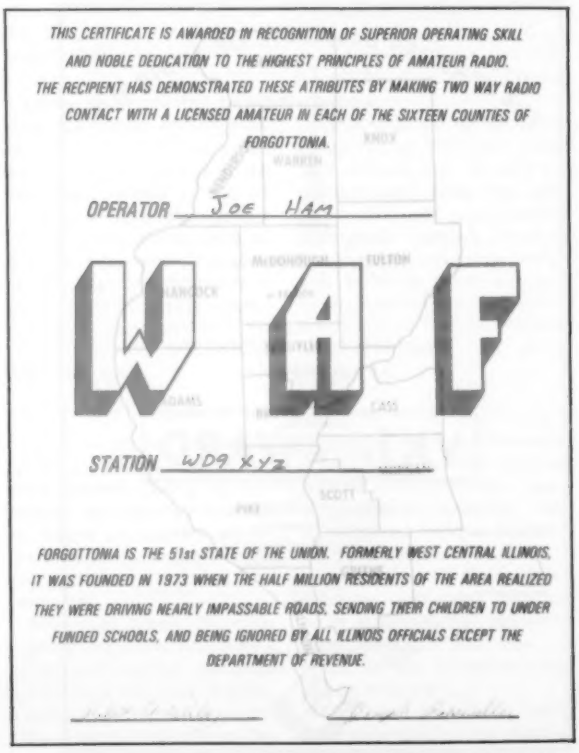
Announcing the awards program sponsored by LEARC, the Lamoine Emergency Amateur Radio Club of Macomb, Illinois. The Worked Forgottonia award is issued amateurs who confirm contact with three (3) licensed amateurs of Forgottonia. The Worked *ALL* Forgottonia is awarded operators confirming contact with at least one amateur in each of the sixteen counties of Forgottonia.

What is Forgottonia? It is the 51st state! It consists of the following counties, formerly west central Illinois: Adams, Brown, Calhoun, Cass, Fulton, Greene, Hancock, Henderson, Knox, McDonough, Mercer, Morgan, Pike, Schuyler, Scott, and Warren counties.

All contacts must be made after June 28, 1980, to be valid. From the letter we received from the club, the award evidently is issued at no charge since no remittance was mentioned. Forward your list of verified contacts and a 9" x 12" SASE to the attention of AG9Y, c/o LEARC, 1224 Maple Avenue, Macomb IL 61455.

JUNIATA VALLEY

In March, the Juniata Valley Amateur Radio Club (JVARC) will be celebrating its 25th year as a bona fide club. In honor of the event, they will be operating a special event station. The club station is K3DNA, located in Lewistown PA (Mifflin county). Having started operation in January, their heavy operation is scheduled for the month of


THIS CERTIFICATE IS AWARDED IN RECOGNITION OF SUPERIOR OPERATING SKILL AND NOBLE DEDICATION TO THE HIGHEST PRINCIPLES OF AMATEUR RADIO. THE RECIPIENT HAS DEMONSTRATED THESE ATRIBUTES BY MAKING TWO WAY RADIO CONTACT WITH A LICENSED AMATEUR IN EACH OF THE SIXTEEN COUNTIES OF FORGOTTONIA.
OPERATOR Joe Ham
WAF
STATION WD9 XYZ
FORGOTTONIA IS THE 51st STATE OF THE UNION. FORMERLY WEST CENTRAL ILLINOIS. IT WAS FOUNDED IN 1973 WHEN THE HALF MILLION RESIDENTS OF THE AREA REALIZED THEY WERE DRIVING NEARLY IMPASSABLE ROADS, SENDING THEIR CHILDREN TO UNDER FUNDED SCHOOLS, AND BEING IGNORED BY ALL ILLINOIS OFFICIALS EXCEPT THE DEPARTMENT OF REVENUE.

March. The station will operate on different bands, CW and phone, according to the operators' wishes. One contact with any club member will entitle the operator to receive the club certificate.

VK1 ACHIEVEMENT AWARD

The A.C.T. Division of the Wireless Institute of Australia is proud to announce the creation of its newest award, the VK1 Achievement Award. This award has the aim of increasing interest in the VK1 prefix and in promoting Canberra and Australia internationally.

As there are only 300 VK1 licensees, the award will not be an easy one to achieve, particularly on some bands and modes.

The VK1 Award is available to licensed amateurs throughout the world. To qualify, stations within Australia must work 20 stations in VK1 land on HF and on VHF. Stations outside Australia must work a minimum of 10 VK1 stations for the HF segment of the award.

To apply, submit your list of contacts, including the GMT time and date worked, the band and mode of operation, and any reports or ciphers exchanged.

To be valid, all contacts must be made on or after January 1, 1978. Endorsements may be given at the time application is made. Five IRCs or $2.00 in Australian currency covers the cost of the award and should be sent to the Award Manager, c/o WIA, PO Box 46, Canberra A.C.T. 2600, Australia.

By the way, the VK1 Award is also made available to shortwave listening stations on a heard basis. QSL confirmation is required.

SNOWFLAKE MADNESS

The Michigan Technological University Amateur Radio Club and the Copper Country Radio Amateur Association announce a radio celebration of our Winter Carnival festivities in the northernmost part of Michigan's Upper Peninsula.

Tech's Winter Carnival is probably the most spectacular winter festival in America, with fantastic snow sculptures, dogsled races, lots of skiing, and other festive events.

In association with the Copper Country Chamber of Commerce, they are issuing a certificate to all amateurs who make contact with any ham in the Copper Country between 0000Z January 25 and 0000Z February 1. Only one contact is required for the certificate.

Suggested frequencies are: 3.975, 7.105, 7.285, and 21.385. Listen for CQ WINTER CARNIVAL.

Send your QSL along with 2 (two) 20-cent stamps to: Kevin J. Nietzke WD8DQR, 2005D Woodmar Drive, Houghton MI 49931.

WORKED BROWARD COUNTY CITIES

The Broward Amateur Radio Club, Inc., sponsors the new WBCC award available to licensed amateurs who submit proof of two-way contact as follows:

A) Residents of Broward, Colliers, Dade, Glades, Hendry, Lee, Martin, Monroe, or Palm Beach counties must work all 29 of the following cities listed below.

B) All other amateurs must work 15 of the 29 cities within Broward county.

To be valid, all contacts must be verified by at least two fellow amateurs and application must show all logbook information as well as the QTH of the station worked.

To apply, mail your application with $1.00 US funds and two first-class stamps (DX stations; send 10 IRCs) to: BARC Award Manager, WD4RAF, 1921 NW 41st Street, Oakland Park FL 33309.

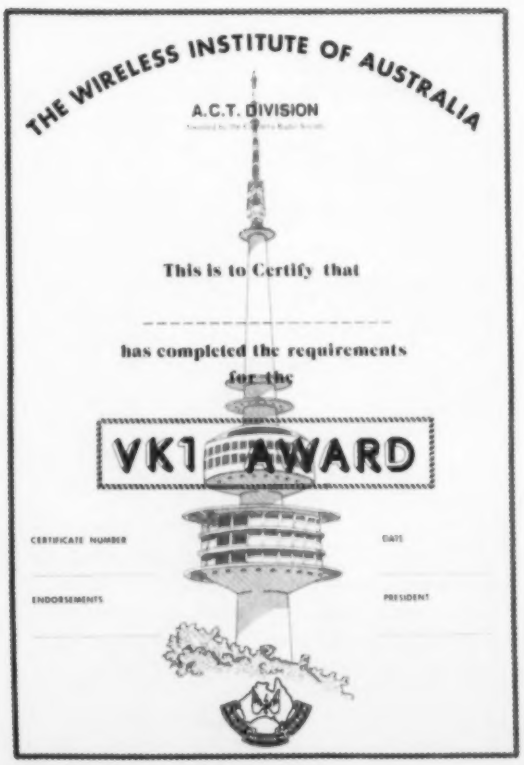
Qualifying city contacts include: Coconut Creek, Cooper City, Coral Springs, Dania, Davie, Deerfield Beach, Fort Lauderdale, Hacienda Village, Hallandale, Hillsboro Beach, Hollywood, Lauderdale-by-the-Sea, Lauderdale Lakes, Lauderhill, Lazy Lake, Lighthouse Point, Margate, Miramar, North Lauderdale, Oakland Park, Parkland, Pembroke Park, Pembroke Pines, Plantation, Pompano Beach, Sea Ranch Lakes, Sunrise, Tamarac, and Wilton Manors.

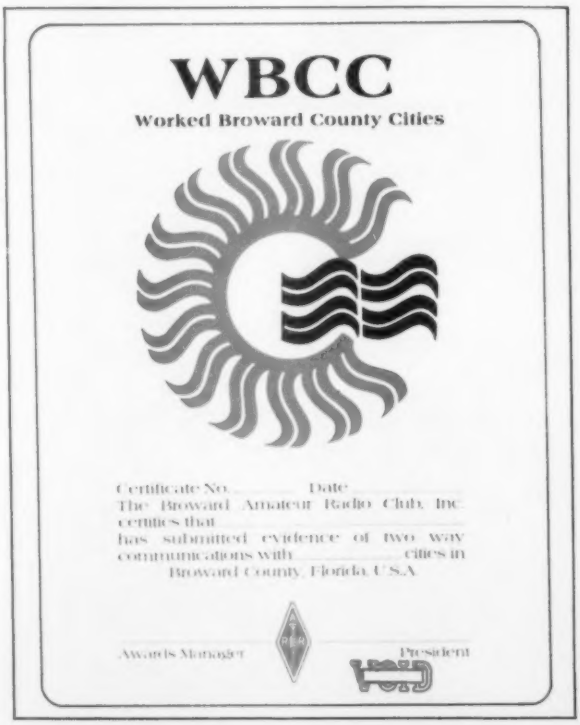
THE SOUTH EAST QUEENSLAND TELETYPE GROUP AWARD

This award is open to all transmitting and listening amateurs who gain award points in the following manner:

Australian amateurs must score 5 points and overseas amateurs must score 3 points.

(a) To qualify, a station must, where possible, copy the official station of the South East Queensland Teletype Group, VK4TTY, during a news broadcast and in the case of a transmitting amateur par-





ticipate in the callback (2 award points). A portion of the printout of the news broadcast together with the date, time, frequency, and broadcast number are to accompany the request for the award.

(b) Additionally, a transmitting amateur must work three member stations of the South East Queensland Teletype Group on RTTY (1 point each). Log extracts and/or printouts are to be included with the award application, and each member station may be counted only once towards the award.

(c) Listening amateurs should, in lieu of (b), forward log extracts and/or printouts of three contacts involving different member stations of the South East Queensland Teletype Group (1 point each).

Applicants for the award should forward the above information together with one dollar Australian or 5 IRCs to cover postage and printing costs to the Secretary, SEQTG, PO Box 274, Sunnybank, Queensland 4109, Australia.

All ASEAN Award ×× **class**

This award is given to *73 Magazine* ***for establishing two way contacts with radio amateur stations in member countries of the ASEAN namely; Indonesia, Malaysia, Singapore, Thailand, and the Philippines.***

Awarded *March 25, 1980* ***by the ORIENTAL DX CLUB, Quezon City, Philippines.***

Edwin Zambrano
President, ODXC

WORKED ALL BERMUDA AWARD

The WAB Award is issued to amateurs throughout the world by the Radio Society of Bermuda. To qualify, applicants must submit proof of having worked a minimum of nine (9) parishes in Bermuda as listed below:

1. Sandys
2. Southampton
3. Warwick
4. Paget
5. Pembroke
6. Devonshire
7. Smith's
8. Hamilton
9. St. George's

The award is an antique map of Bermuda (20" x 23") suitably inscribed with the recipient's name and callsign and is signed by His Excellency, the Governor of Bermuda.

The award is not available to stations who worked Bermuda via mobile including maritime or aeronautical mobile. No band or mode endorsements are available. Only one mobile or portable from within Bermuda may be used in making claimed contacts on your application.

QSL cards are required as proof of contact and they must be sent to the awards manager with sufficient postage for their safe return. The Bermuda Award is issued free of charge! Submit your applications to: Award Manager, PO Box 275, Hamilton 5, Bermuda.

WORKED ALL DU AWARD

This award is available to all licensed amateurs who can show proof of having contacted at least one station from each of the call areas in the Republic of the Philippines (DU1 to DU9, except DU5).

Contacts may be made on any band or mode and special endorsements will be issued upon request for All-Phone, All-CW, Single-Band, or Five-Band accomplishments.

Contacts for the DU Award must be made on or after January 1, 1970. To apply, forward a list of contacts which have been verified by two officers of a radio organization. Your application must show all logbook information for each contact. Send the list and $4.00 US funds only (no IRCs please!) to: Edwin Zambrano DU1EFZ, PO Box AC-166, Quezon City 3001, Philippines.

WORKED ALL ASEAN AWARD

The WAAA program requires the applicant to work other amateurs in the member countries of the Association of Southeast Asian Nations:

Work 5 Philippine contacts, 1 Malaysian contact, 2 Indonesian contacts, 1 in Thailand, and 1 station in Singapore.

Special endorsements will be given for All-Phone, All-CW, Single-Band, and Five-Band contacts.

Have your list of contacts verified by at least two radio club officials and be sure all contacts were made after January 1, 1970, to be valid. Forward appropriate logbook information in your application along with $4.00 US funds only (no IRCs) to the Award Manager: Edwin Zambrano DU1EFZ, PO Box AC-166, Quezon City 3001, Philippines.

KAHANER REPORT

Larry Kahaner WB2NEL
PO Box 39103
Washington DC 20016

By now you probably know that the FCC gave up in its attempt to rewrite the Amateur Radio Service rules. After spending thousands of dollars and consuming thousands of man-hours, the whole idea was thrown in the trash compactor.

We may never learn exactly what led to the shelving of the massive revamp nor will we ever realize any benefit from all that work. However, several FCC employees said privately what we all know intuitively about the project: It was just too big and too complicated to be completed.

You must admit the main premise was sound. Whenever a government agency wants to put its rules into plain English, we should all support it. In this case, it went a little too far. Opponents called the rewrite overly simplistic and said that many of the fine points of amateur radio were lost in the translation. They also claimed that the question and answer format—which worked so well for the rewritten CB rules—just didn't work for hams. Amateurs, they declared, were intelligent and took offense at the condescending stance of Q & A.

Moreover, the bulk of hams who responded to the petition

for rulemaking took umbrage at the very beginning of the rewrite proposal which dropped the famous reasons for amateurs' existence: promoting international goodwill, experimentation, and so on.

FCC officials told us that the rewrite contained many errors and mistakes—not just typos, but in substance as well. And although FCC proposals always contain errors, in this case it would have been just too much work to set things right. Normally, the commission works with opponents and proponents alike until the regulations are honed to where everyone can live with them. But for the ham rewrite, there was too much to do, too few staff to do it, and no funds available to keep the project alive.

On one hand, the FCC should be applauded for realizing that it would take resources beyond its means to complete the task and dropping it now before any more time and money was wasted. On the other hand, perhaps the commission should be scolded for even beginning a course of action that came under fire from hams at the onset. Even those in the commission expressed doubts as to whether it was necessary to rewrite the rules. It's certainly apparent that much of the impetus for change was political (see Kahaner Report, September, 1981). That should never be a reason for a government agency to do anything with taxpayers' money.

So, it seems that hams fought the measure and won. But the question arises—who lost?

OUR OWN CHANNEL 9

Paul Moratto KC5JK/6, from Universal City CA, mailed the FCC a petition for rulemaking requesting that it designate a particular 2m frequency to be used exclusively as an emergency and assistance channel. Paul also sent us the petition asking for our comment. Here goes.

It's a great idea, Paul, but it's not necessary. Hams don't need the FCC to set aside a special channel for emergency use. Hams can do it on their own.

If hams can set up a national simplex channel (.52) and work out an entire repeater coordination scheme which only few hams don't adhere to, they can certainly decide for themselves if they want one frequency designated for emergency and assistance use only.

In his petition, Paul noted: "Various law enforcement officials have stated that the 2-meter amateur band is rarely monitored due to that fact that *no emergency frequency* has been officially designated exclusively for such communication." Frankly, Paul, I doubt that police departments would be willing to shell out bucks for a scanner that would pick up 2 meters or even buy crystals to place in scanners they may already own. Indeed, cops have enough to listen to without keeping an ear open on another frequency. If and when ham radio ranks reach that of CBers, maybe they'll listen—but right now it's not worth it.

Besides, even if they heard a distress call, they couldn't respond unless they were licensed hams. Many police are, but many aren't.

Any hams out there want to start work on a national emergency channel? Be my guest. Although I can't answer for the FCC, I'll bet they'll tell Paul exactly what I just told you: "If you want to do it, do it. You don't need us."

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

RSGB 7-MHZ CONTESTS

Phone Section
Starts: 1200 GMT February 6
Ends: 0900 GMT February 7
CW Section
Starts: 1200 GMT February 27
Ends: 0900 GMT February 28

Licensed radio amateurs and listeners throughout the world are invited to take part in this year's RSGB contests. Log and cover sheets may be obtained from RSGB Headquarters, 35 Doughty Street, London, England WC1N 2AE. Please include an SAE.

The general rules for RSGB HF contests, published in the January, 1982, issue of *Radio Communication*, will apply. Please note, however, that unmarked duplicate contacts will be penalized at 10 times the number of points claimed, and that logs containing in excess of 5 unmarked duplicate contacts will automatically be disqualified. Duplicate contacts should be included in your logs, marked as such, and without any claim for points.

Only RSGB members within the British Isles are eligible, while anyone else worldwide may enter. The only valid operating class is single operator.

EXCHANGE:

RS(T) plus serial number starting at 001.

FREQUENCIES:

Phone—7.04 to 7.1 MHz; CW—7.00 to 7.04 MHz.

SCORING:

Non-European stations with British Isles count 15 points per QSO. European stations with British Isles count 5 points per QSO. British Isles stations with European stations count 5 points per QSO, 15 points per non-European contact. British Isles stations may not work each other.

Multiplier for British Isles stations is the number of different countries worked—ARRL DXCC list applies. In addition, each VE, VK, W, ZL, and ZS call area counts as a country for this purpose.

Non-British Isles stations count one multiplier for each different British Isles prefix worked, maximum of 42. Please note that GB does not count!

Final score for all is QSO points times the total multiplier.

AWARDS:

The Thomas (G6QB) Memorial Trophy will be awarded to the leading British Isles entrant in the CW contest. Certificates will be sent to the entrants placed first, second, and third in the British Isles, European, and non-

CALENDAR

Feb 6-7	**RSGB 7-MHz Contest—Phone**
Feb 6-7	**South Carolina QSO Party**
Feb 6-7	**Arizona QSO Party**
Feb 13-14	**WAS SSTV Contest**
Feb 13-14	**QCWA QSO Party—CW**
Feb 20-21	**ARRL DX Contest—CW**
Feb 26-28	**CQ Worldwide 160-Meter Contest—SSB**
Feb 27-28	**RSGB 7-MHz Contest—CW**
Mar 6-7	**ARRL DX Contest—Phone**
Mar 13-14	**QCWA QSO Party—Phone**
Apr 17-18	**ARCI QRP Spring QSO Party**
Jun 12-13	**ARRL VHF QSO Party**
Jun 26-27	**ARRL Field Day**
Jul 10-11	**IARU Radiosport**
Aug 7-8	**ARRL UHF Contest**
Aug 14-15	**European DX Contest—CW**
Sep 11-12	**ARRL VHF QSO Party**
Sep 11-12	**European DX Contest—Phone**
Nov 6-7	**ARRL Sweepstakes—CW**
Nov 13-14	**European DX Contest—RTTY**
Nov 20-21	**ARRL Sweepstakes—Phone**
Dec 4-5	**ARRL 160-Meter Contest**
Dec 11-12	**ARRL 10-Meter Contest**

European sections of each contest.

ENTRIES:

Log sheets should be headed: date, time (GMT), callsign of station worked, RS(T) and number sent, RS(T) and number received, if multiplier, and QSO points claimed. A summary sheet is required showing the countries or prefixes worked. Each log must be accompanied by the following declaration: "I declare that my station was operated in accordance with the rules of the contest and in accordance with the terms of my license." The declaration must be signed and dated. Closing date for receipt of logs is April 3rd for the phone section and April 24th for the CW section. Address entries to: RSGB HF Contests Committee, PO Box 73, Lichfield, Staffordshire WS13 6UJ England. In the case of any dispute, the ruling of the Council of the RSGB shall be final.

RECEIVING SECTION:

Rules are generally the same, as applicable. British Isles entrants should log only overseas stations in contact with British Isles stations and must record the report and serial number given by the overseas station and the time in GMT. European stations logged count 5 points; outside Europe, 15 points. No more than 20 QSOs made by any one British Isles station may be logged.

Overseas listeners should log British Isles stations and must record the reports and serial numbers given and the time in GMT. European listeners claim 5 points per QSO logged; others, 15. A bonus of 20 points may be claimed for each British Isles numerical prefix logged. GB prefixes do not count, and not more than 20 QSOs made by the same British station may be logged.

ARIZONA QSO PARTY

Starts: 2000 GMT February 6
Ends: 0800 GMT February 7

Sponsored by the Arizona Amateur Radio Club. Each station may be worked only once per band.

EXCHANGE:

RS(T) and state, province, country, or AZ county.

FREQUENCIES:

SSB—1815, 3895, 7230, 14280, 21365, 28560. CW—1805, 3560, 7060, 14060, 21060, 28060. Novice—3725, 7125, 21125, 28125.

SCORING:

Count 1 point per SSB QSO and 2 points for each CW or "exotic" mode QSO. AZ stations multiply QSO points by number of states, provinces, and countries. Others multiply QSO points by number of AZ counties. The AARC club station W7IO also counts as 1 multiplier for non-AZ stations. Anyone working all AZ counties and W7IO may double the multiplier.

AWARDS:

Certificates for the highest scoring station in each state, province, country, and AZ county.

ENTRIES:

Show each station worked, RST and exchange, plus time and frequency. Include a summary sheet of your scoring and other information. Include a large SASE for results. Mailing deadline is March 6th and should be addressed to: AARC, c/o Gary Kent KB7VE, 16647 N. 34th Avenue, Phoenix AZ 85023.

SOUTH CAROLINA QSO PARTY

Starts: 1800 GMT February 6
Ends: 2359 GMT February 7

The QSO party is again sponsored by the Colleton County Contestors. The same station may be worked on each band and mode, simplex only. SC mobile stations that change counties are considered new stations. Novice and Technician stations please sign /N or /T.

EXCHANGE:

RS(T) and state, province, country, or SC county.

SCORING:

Phone contacts are worth 2 QSO points, CW contacts are worth 3 points. The multiplier for SC stations is the number of states, provinces, and DX countries worked. Others multiply QSO points by the number of SC counties worked (46 maximum).

FREQUENCIES:

Phone—3895, 7230, 14280, 21365, 28560. CW—3560, 7060, 14060, 21060, 28060. Novice—3725, 7125, 21125, 28125.

AWARDS:

Certificates to top-scoring station in each SC county, state, province, and DX country. Novices and Technicians compete only with other Novices and Technicians.

ENTRIES:

Include a summary sheet with your entry showing scoring and other information. Indicate each new multiplier in your log as it is worked. Novice and Technician indicate class on your entry. Include a large SASE for results. Mailing deadline is March 5th; send to: Colleton County Contestors, c/o Elliott Farrell, Jr. WA4YUU, PO Box 994, Walterboro SC 29488.

QCWA QSO PARTY—CW

Starts: 0001 GMT February 13
Ends: 2400 GMT February 14

This is the 25th annual QCWA QSO party with separate weekends for CW and phone. Contacts with the same station on more than one band can be scored only once. Contacts made with "captive" stations, such as when operating in local nets, are not valid.

EXCHANGE:

QSO number, operator's name, and QCWA chapter identification (official number or name). Members not affiliated with a chapter should use "AL".

FREQUENCIES:

Any authorized amateur frequency is permissible. The following suggested frequencies have been selected to minimize interference to others: 3530-3560, 7030-7060, 14030-14060, 21040-21070, and 28040-29070. These are selected as a starting place. When pileups occur, don't be afraid to go either side of these frequencies.

SCORING:

Each contact made with another QCWA member will count as a single point. This year's contest has two multipliers. The first is the same as in years past: each chapter is a multiplier of one. The second is that DX sta-

RESULTS

RESULTS OF THE 1981 OHIO QSO PARTY

Ohio Stations	Score
WB8MZZ	1,501,640
KB8EI	820,155
WB8JBM	666,000
WD8ALG	448,707
KA8HXX	428,736
KC8JH	339,000
KF8K	206,550
N8AKF	163,674
KA8IAH	148,830
KA8CTL	104,636
KB8AC	100,940
N8JJ	47,120
W8DXT	45,628
WA8WFX	39,285
WD8MCO	33,178
KB8WB	31,820
KA8IGM	31,620
WB8MIP	28,968
W8HFK	26,048
N8DCJ	23,408
N8BJQ	12,810
W8OJM	3,335
W8VPV (Club Station)	183,012

Out of State		Score
WA0AVL/9	IL	11,086
W4FOA	VA	10,480
KA2EPS	E NY	5,550
K9GDF	WI	4,008
W2EZ	W NY	3,900
KA8LPV	MI	3,810
K8EIO/3	MD/DC	3,430
NO4P	KY	3,360
WB3IET	W PA	3,240
W4OVT	GA	2,940
WB4ZPF	VA	2,875
N0CLV	KS	2,314
N1BDB	CT	2,180
W4KMS	VA	1,692
WB3FNS	MD/DC	1,628
N4CD	VA	1,552
KG9Z	IL	1,482
WB9CWE	IL	1,364
WA3JXW	E PA	1,232
WA3GNW	E PA	828
WB9NRK	WI	780
K2NC	W NY	737
WB1GLH	MA	672
W4LEP	TN	588
WA9MRU	IL	576
WB7TJI	ID	351
KA1VE	MA	340
N5AFV	OK	306
KA2EGO	N NJ	208
AK7J	ID	165
KF2T	N NJ	132
KB9TI	IL	90
K1BV	CT	50

QSL OF THE MONTH

Call us chauvinists, but the beautiful rendition of the New Hampshire countryside on this attractive card wins WB1GGQ his choice of any book in *73*'s Radio Bookshop.

Is your card a winner? To enter, place your card in an envelope along with your book selection and mail to *73 Magazine*, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. To be eligible, your entry *must* be sent in an envelope and *must* be accompanied by your book selection.

tions are a multiplier of two. DX stations are defined as Europe, Africa, South America, Asia, and Oceania—the same as for WAC of ARRL. Contacts within your own country count only as a chapter multiplier. Final score is then the total QSO points times the sum of the number of chapters and DX stations worked.

AWARDS:

Plaques for the top phone and top CW scorers. Certificates will be given for the 2nd through 5th runners-up in both the phone and CW Parties. Standings and scores will be published in the *QCWA News*, issue of summer, 1982.

ENTRIES:

Logs should include the following information: time (GMT), call, QSO numbers, name, chapter number or name, state or country. It is the responsibility of each contestant to provide a legible log, no carbon copies, and to list all claimed contacts. The total contacts for each page will be recorded at the bottom of each page. The total contacts for the Party should be recorded at the top right of the first page of the log. Log sheets will not be returned. Make sure you have correct postage when you mail your logs. Send logs no later than March 31st to: Pine Tree Chapter 134, Glenn Baxter K1MAN, Long Pond Lodge, Belgrade Lakes ME 04918. Separate logs and scores must be submitted for the CW and phone parties.

Work as many QCWA members as possible and apply for the several special QCWA certificates which you have qualified for in the QCWA Parties: Worked 50 States, Worked 60 Chapters, Worked 100 Members, and Worked 500 Members.

WAS SSTV CONTEST

Starts: 0900 EST February 13
Ends: 2100 EST February 14

Sponsored by amateur television's *A5 Magazine*. Use all authorized and recognized SSTV operating frequencies within the HF bands. Attempt to work as many SSTV operators from other states as possible during the 36-hour contest period. The emphasis is on quality, not just quantity.

SCORING:

Count 25 points per contact with 10 bonus points awarded for live exchanges of "mugshots," color two-way contacts, or 256 or 128 (1/2-speed) mode transmissions. Add 100 points for each new state listed. Alaska and Hawaii contacts count a bonus factor of 500 points!

EXCHANGE:

Station calls and signal reports must be exchanged in video format by either camera, keyboard, or light-pen generators.

AWARDS:

First-place winnner receives a 3-year subscription (or renewal) to *A5 Magazine*, a framed Specialized Communication Certificate, and his photo published on the front cover of the magazine. Second- and third-place winners receive 1-year subscriptions and certificates. All contestants will receive gold certificates with submitted logs.

ENTRIES:

Submit actual or copies of contest log sheets by no later than March 1st to Contest Manager, *A5 Magazine*, PO Box H, Lowden IA 52255. Official results will be published in the May/June issue of *A5 Magazine*. Those winners attending the Dayton, Ohio, Hamvention will be awarded certificates at the regular ATV Forum meetings.

CQ WORLDWIDE 160-METER CONTEST—SSB

Starts: 2200 GMT February 26
Ends: 1600 GMT February 28

EXCHANGE:

RS plus a three-digit contact number starting with 001. US stations include state and Canadians include province.

SCORING:

US and Canadian stations count 2 points per QSO with other W/VE/VO stations; DX contacts are 10 points each.

DX stations count 2 points per QSO with stations in the same country and 5 points with stations in other countries. QSOs with W/VE/VO stations are 10 points each.

All stations count one multiplier point for each US state, VE province, and DX country. KH6 and KL7 are considered DX. Final score is total QSO points times the sum of multipliers.

AWARDS:

Certificates to the top scorers in each state, VE province, and DX country. Additional awards if the scores or returns warrant.

Two plaques are being awarded by the West Gulf ARC, both for single operators, one for the highest scoring US station and the other for Europe. The World Champion in the contest will receive the John Doremus W0AW Memorial Plaque from friends of W0AW. This plaque may be won only once by the same station in a three-year period.

PENALTIES:

Three additional contacts will be deleted from the score for each duplicate, false, or unverifiable contact removed from the log. A second multiplier will also be removed for each one lost by this action.

Violation of the rules and regulations pertaining to amateur radio in the country of the contestant, or the rules of the contest, or unsportmanship conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed sufficient cause for disqualification. Disqualified stations or operators may be barred from competing in *CQ* contests for a period of up to three years.

ENTRIES:

Sample log and summary sheets may be obtained from *CQ* by sending a large SASE with sufficient postage to cover your request. It is not necessary to use the official form; you can use your own. Logs should have 40 contacts per page and show time in GMT, numbers sent and received, and separate columns for QSO points and multipliers. Indicate the multiplier only the first time it is worked.

Mailing deadline for SSB entries is March 31st. Logs can be sent directly to the 160 Contest Director, Don McClenon N4IN, 3075 Florida Avenue, Melbourne FL 32901 USA. Alternatively, they can be sent to *CQ*, 160-Meter Contest, 76 North Broadway, Hicksville NY 11801 USA.

NEWSLETTER CONTEST WINNER

Humor is a key part of this month's newsletter winner. *The National Hampoon*, published by the Cleveland-based South East Amateur Radio Club, is chock full of puns, good-natured put-downs, and inside jokes. Editor KA8KTR is not above poking fun at himself or the 33-year-old club. Besides being fun to read, *The National Hampoon* provides a deluge of information about what individual club members are doing. Don't let your club's members fall into the trap of not reading each newsletter. Try adding some life and humor; the readers will anxiously await the arrival of the next issue.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

"This section shall not apply to receiving, divulging, publishing, or utilizing the contents of any radio communication which is transmitted by any station for the use of the general public; or which refers to ships, aircraft, vehicles, or persons in distress; or which is monitored pursuant to section 4(f)(6) and which is received, divulged, or used in any investigation or enforcement action by the Commission."

Explanation

This amendment conforms §605 to §4(f) to accommodate proposed language to permit use of volunteer monitors.

Here is another way that amateurs could help the Commission cut down on their costs. Not that they are spending a lot monitoring the ham bands these days anyway... and who needs 'em? But with the rules changed so that amateurs could set up a monitoring system, we would be able to clean up a lot of miseries which are now plaguing our bands.

We have tens of thousands of retired hams and several thousand more handicapped hams, all with loads of time on their hands and an eagerness to be of value. Well, here is a service that these hams could provide which would be priceless to us. I've talked with the FCC commissioners about this and they seem to be enthusiastic about the concept. You see, not only could hams be organized to monitor the ham bands, but they could also assist the FCC monitors in watching over some of the non-amateur bands, too.

If we once started getting into this monitoring idea, it would not be long before innovative hams would start coming up with automatic band scanners and receivers which would be connected to microcomputers and would program themselves to listen for unrecognized transmissions. With digital receivers and frequency counters, it is only one more step to a system which will keep track of what signals are okay on what frequencies and spot the anomalies quickly so they can be identified.

Not only would this be of great help for digging out emergency signals fast, but it would be even better protection against illicit transmissions involved with spying and drug traffic and so on. Coded transmissions? We have some mighty sharp ham cryptographers who would love to have challenges like that.

Why should the government spend wads of money doing something which we not only could do but probably could do better, and which we would enjoy doing?

Yes, a ham monitoring system would take some organization, but it wouldn't be difficult to handle. Much of the work could be done over the air, with unknown signals spotted and triangulated via a ham net. And with hams everywhere, even the UHF channels could be watched over in every part of the country. This would raise hell with crooks using CB or HTs on commercial channels to coordinate crimes. There would be no safe frequency or place in the country for them. Pity.

FRIENDLY CLUBS

Several letters from readers have made mention of a situation which I've noticed in some clubs I've visited... a lack of friendliness. Oh, it isn't intentional... but it is a drag. I suggest that club officers take a good critical look at the way their club is working and start doing something about it.

When someone new comes to a club meeting he (or she!) should be met by members and introduced around. Each person should have an identification badge so newcomers will know to whom they are talking. Members of the club should be aware that it is their responsibility to go out of their way to be friendly with any newcomers... to talk with them... show them around. Have the glad hand out.

When the newcomer arrives, try to find out about him... his call, if licensed... or if he is not yet licensed and might be interested in coming to the club license classes... what bands he works... and so on. Then get up at the meeting and introduce the newcomer and tell about his background so the others will know him. Make a big deal out of the newcomer and he will be back. You won't be able to keep him away with a stick.

In case you haven't noticed it, darned few hams are outgoing. The gregarious ham is unusual. Most hams are loners who may do just fine on the air, but are afraid to talk on a one-to-one basis. You should recognize this and gear your club meetings to overcome this situation. If you have a table where they can show their new and exciting QSL cards... that's a conversation breaker. Another table where they can show something they've built is another winner. Perhaps a spot to show off newly-purchased ham gear... stuff that is just recently on the market. Everyone is always interested in new rigs and gadgets. Anything you can work up in ways to get members showing and telling will break the ice and help everyone have a good time... and it is a good time at meetings which will bring 'em back alive next month.

This isn't the time to get into the details on how to run a ham club, but I will just touch on some of the basics. Remember that when you are running a ham club you are in show business. You want to keep for the board of directors as much of the dull business aspect of the club as you can, letting the meetings be times when you are entertaining the members.

What is entertaining? Well, demonstrations of unusual modes of communications are winners. You probably have someone in the area who is working with slow scan and can knock the socks off the members with color slow scan. Or perhaps some members are into computerized RTTY communications. Anything on 10 GHz? Any new antennas popped up which can be shown on a blackboard and explained? Slides of a Dxpedition are great fun.

How much do the members know of what is going on in the 450-MHz band? How about 220 MHz? Anyone working with SSB on 2m? How about aurora DXing, meteor-scatter DXing, moonbounce?

Manufacturers will go a long way to show their products when they have something new. Keep your eye on the new products section of *73* and see what you can generate. They want to show their products and they also want to get feedback from your members on possible new products. They need both the sales and the input.

DEREGULATION

The interest in deregulation by the Commission got started back in 1974, triggered by the *en banc* hearing at which a group of amateurs testified as to the need for deregulation. This turned out to be a matter of doing the right thing at the right time... as the Commission was just at that time getting interested in the concept. The hearing made clear the need for deregulation of amateur radio, and the Commission started with our service, intending to use it as an example of what could be done.

The hearing, by the way, was in response to the then-new regulations on repeaters, which were particularly onerous. Lacking any initiative from the ARRL, I got representatives together from repeater groups all around the country to testify before the Commissioners. If anyone is interested, I have a tape of this historical confrontation. The ARRL refused to participate, putting the effort down as naive and useless. The result was the biggest change in our rules ever brought about.

Of considerable significance is a recent paper (August, 1981) from the FCC. This is a working paper on deregulating the personal and amateur radio services. The paper is quite candid... surprising in its frankness. There are some interesting concepts..."many...agree that the goals of expanding technical skills and manpower and advancing the radio art have fallen on hard times in recent years." It goes on, "If there is criticism of amateurs for not being technically more advanced, it could be misdirected. Perhaps one should place some of the responsibility on the regulations, not the licensees. Substantially more regulatory flexibility than

the service now has would be desirable."

Frankly, that's an understatement.

The other day, on my way down to Florida to give a talk to a group of accountants who are using TRS-80 systems, I stopped by Tufts Electronics in Hudson, New Hampshire. Chuck recently moved from down near Boston to tax-free New Hampshire, thus saving nearby Massachusetts hams a bundle on their purchases. The new Yaesu FT-208R HT had just arrived, so I bought one.

As I punched up the channels on the synthesizer, programming the unit to scan several local repeaters and a simplex channel or two, I got to thinking about the whole two-meter US vs. Japan situation. Having been in the 2m ham field for over 40 years, I remember how things got started.

The first FM rigs were converted commercial systems, mostly by Motorola and G.E.—monsters, dumped on us when the commercial two-way specs were changed, rendering tens of thousands of taxi and police transceivers obsolete. Then came a rig from I.C.E. (in Texas) which never got to first base... mostly because it didn't work very well. The next try was from Galaxy (Missouri). Though unstable and much too large, it sold reasonably well. The engineering design was dismal. Ed Clegg, who had been building VHF equipment for us for years, came up with one of the better FM rigs of the time, but by then some of the Japanese equipment was starting to arrive.

Icom was designing very nice equipment, and it was selling well. Unfortunately, the company was taken to the cleaners by a crooked Arizona importer/distributor. Nothing daunted, Mr. Inoue, the president of the firm, came to the US and shopped around for a new importer. He also asked a lot of questions about what kind of new equipment was wanted... and listened carefully to the answers. The result was the IC-230, the first synthesized ham rig. Before that, the best-selling rigs were from Standard and featured ever more crystal sockets. I got to where I had to have hundreds of crystals on hand to cope with all of the repeaters going on the air... and the many different rigs.

Mr. Inoue said that he would some day be able to put a synthesizer into an HT for us. Well, we knew it would happen, but it seemed like a dream. You know, there was a small outfit out near Buffalo, New York, which came up with a synthesizer early in the game, but they never really followed up on it. It started out as a club project and then changed into a business. I think if they'd played their advertising right they could have developed into a large business by now with perhaps $50 million in sales.

Another firm which had a crack at it and dropped the ball was Vanguard, down on Long Island. Andre developed a synthesizer to plug into the older rigs, but didn't take it the next step.

It isn't really fair to put down US firms for losing the ball on FM equipment... or any other ham gear for that matter. You see, the Japanese went right on by us in the number of licensed hams, so their firms had a great advantage. Not only did they have more hams, but their hams were much more enthusiastic and active than we were. Amateur radio really took hold in Japan when they got rid of the Morse code requirement. Clubs sprang up in high schools all over the country, and today they have double to triple the number of active hams that we have. Further, their spirit is almost unbelievable.

Have you even thought of going on a DXpedition? Well, the Japanese have organized DXpeditions where they have had about 400 active hams going along and getting on the air! When you read the Japanese club magazine you find that it is packed for dozens of pages a month with pictures of club activities and outings. We don't appear to have a single club in the US which even comes close to the enthusiasm which has spread through Japan... at least I'm not familiar with any. I've asked several times for pictures of any outstanding club activities for publication in *73*... nothing yet.

One of the facts of business is that the more of the product you make, the cheaper it is to manufacture. When you double the production of a piece of equipment, the cost of making it goes down 15-25%. So this bunch of eager buyers in Japan has done two things to the ham equipment market. First, their enthusiasm has encouraged the Japanese firms to keep up a continuing development of new equipment. The volume of sales has forced American firms out of the market because the Japanese equipment has been both better and cheaper in most instances.

Where the shoe really begins to hurt is that we are now seeing the results of the over 500,000 Japanese hams and their enthusiasm. These chaps have now gone from high school through college, on into industry, and are wiping out the American consumer electronics industry. Their rate of graduation of engineers, technicians, and scientists has zoomed past ours.

In this respect, amateur radio has let America down. If you stop and think about it, most technical career people get started in their teens. By stopping the growth of amateur radio in 1963, with little since then, we have managed to kill off virtually a whole generation of technical people. Unless a person gets interested in electronics in high school, there is little reason for him to go into electronics as a career. So now we have a bunch of philosophy and liberal arts majors wandering around looking for work... while our electronics industry is getting wiped out by Japan.

There really isn't much we can do about the situation right now. We will be outgunned in technicians for some time to come. If we are going to get back into the driver's seat, we are going to have to figure out some way to get a whole generation of teenagers interested in technical careers. That's quite a challenge.

In the meanwhile, as I go further and further into the instruction book for the 208, I wonder what next in HTs. With the LCD display of the frequency, the 208 should have a substantially longer battery life than the 207. I like the scanning system... just what I've wanted for years, wherein it scans, stops on a busy channel for a few seconds, and then continues scanning. You can set it up for a priority channel... for instance, I generally monitor 147.540 for simplex calls. They've even made the battery compartment so that you can open it without a coin.

I picked up a mailing piece at Tufts which was rather clever... and sad. The headline on it was, "Where have all the amateur radio stores gone?" Then there are drawings of eleven graves with headstones for the eleven Greater Boston ham stores which have gone out of the ham business (or just plain out of business) in recent months.

With the recent even further drop in new licensees... down around 35%... ham stores all around the country are folding. The ones that seem to be failing the most are those which had little slogans such as, never undersold... call for low, low prices... 20% off... and so on. You know, unless we do something about all this, amateur radio will soon be little more than a retirement playground for elderly hams.

I admit to getting a bit frustrated when I visit some ham clubs and find that many of the members... old-timers, of course... are prepared to resist any efforts to bring in new hams as much as they can. They don't want the QRM... and they don't much enjoy talking to young hams... and don't want them trying to join their club. They would like to raise the code speed to 50 wpm and have everyone coming in pass the Extra class license exam... and then get restricted to the CW bands for a few years. They like *QST*, not *73*. These chaps are turning amateur radio from a friendly fraternity into an old farternity.

Apropos of the mention of the 1963 debacle, I looked back over my editorials and found that I had indeed predicted at the time that one of the results of the proposed rules change would be the demise of a great many dealers... and manufacturers. About 75% of the ham dealers

WARNING

Due to numerous complaints received from readers who have dealt with Electronic Specialties, Inc., of Miami, Florida, we have discontinued their advertisements and urge all readers to use caution when dealing with this firm.

went out of the ham business as a result... and most of the manufacturers. It's interesting to see the old ads for Hammarlund, Hallicrafters, National, Johnston, Squires-Sanders, Central Electronics, Lakeshore, Multi-Elmac, United Transformer, Stancor, Bud, Gonset, Polytronics, and so on. It sure wiped 'em out.

The 208 is a great rig... but it is not a breakthrough into anything really new. If we're going to get amateur radio pepped up, we have to get into the 80s and digital communications techniques. We really have nothing new to be excited about. FM is a bore for most of us... and heck, DX has been around for a lifetime. What have we that is really new and fun? We need something to get our juices flowing.

What have you got?

HAM WATCH REPAIR

Eventually, those Casio C-80 and C-90 watches run out of battery and need to get a battery refill. The replacement of the batteries isn't a really big deal... you can probably do it. Or, of course, you can fire it back to Casio for their $10 repair charge. Many jewelers are afraid of digital watches and claim they can't fix them. Tsk.

You can run into a problem with the Casio watches in that they often do not start when you replace the batteries. You have to short out the battery cover and a nearby metallic dot marked "AC" with a wire, tweezers, or even a paper clip to get the watch to start again. Jewelers have gotten instructions on this, but often just don't want to be bothered... or didn't read the instructions.

The C-80 and C-90 Casio watches, which I've written about before, are the ones which did the most to put both Texas Instruments and Commodore out of the watch business. Casio came out with a $50 watch which knocked the socks off everything else on the market. More and more of us around the magazine are wearing the C-90, beeping away every hour in unison.

My thanks to WB9OJD for the battery information on the watch.

GETTING RICH

Firms which are publicly held have a problem that privately owned firms don't have to worry about: making ever more money to keep the stock prices high.

This came to mind when I got a letter the other day... and not the first one... saying that the reason I want ham growth is so that I can make more money from *73 Magazine*. Let's take a good look at that cop-out.

First point. If I *were* interested in money, spending time on trying to get amateur radio growing would be one of the last ways I would invest my time. The real money today is in microcomputers, and the maximum return for hours spent is obviously in that field. Every time I start a new computer magazine, I generate a couple of million dollars more cash flow for us and bring employment to a bunch more people. I also help the microcomputer field to grow by virtue of the communications I bring about.

No, from a business point of view, I could care less whether amateur radio grows or not. If I were to fold up *73 Magazine*, we'd make more money using the people and facilities for the much, much more profitable computer publications. But I'd miss a lot of fun... and amateur radio would lose a lot of articles and enthusiasm.

Point Two. Even if we got into a great growth pattern and *73 Magazine* started to make a huge profit, the money would go toward my real goals, not to me. My goals are to provide education through my publications and through any other media available. If I had a million to spare right now, I would quickly put it into the development of Hawthorne-Green Institute, a college to teach electronics, communications, and computing.

I seriously doubt if many readers spend much less on themselves than I do. I do have to buy clothes so I look well, even if I begrudge the expense. That's part of being in business. My entire life revolves around the business. I grab breakfast at my desk, have a business lunch almost every day... or else I eat an apple and cheese at my desk. Dinners are often with advertisers, at ham clubs, computer shows, or on trips to visit manufacturers. I don't think my wife and I get together to eat dinner at home ten days a year. She, too, is wrapped up in our business, and we share a two-room apartment in the old house that is our headquarters building.

I'm serious about trying to get American technology back into the lead and I think I have the key to this. If you were in my shoes, wouldn't you feel that was a worthy goal? Further, I think it is a goal I can achieve.

Probably the "richest" time of my life was back in the mid-50s when I was the editor of *CQ* and also the president of a small hi-fi manufacturing firm. I made a big $15,000 at that time, which is a whole lot more than I'm making now in today's dollarettes. I was able to support a home, family, a seaplane, an Arabian horse, a small yacht, and two Porsches. One of the things which I learned was that toys like those own you, not the other way around. The horse had to be exercised every day... and trained. The Porsches needed constant service, most of which had to be self-provided. The damned yacht had to be scraped and painted every year or so, the engine worked on, and so on. The plane? You have no idea of misery until you own your own plane. It cost more per year to own and run than any two of the other toys. It was fun and I'm glad I did it, but I'm all over wanting yachts and planes.

Money has value only for what it can do towards my goals. If I can generate more, I can do more... and there is far more satisfaction in that than having a pocketful of hundred-dollar bills... or a bankful.

I have this dream of being able to help get amateur radio into more countries... as a way of helping those countries to grow. Countries have a desperate need for electronics and communications experts... technicians, engineers, and scientists. The best way, by far, for getting these needed people is via infection of teenagers with the virus of electronics... and that means amateur radio. It works!

If the United States is going to stay on top over the next generation or two, we need to invest in technical people. I'm working on that via my push to get amateur radio and computer clubs into every high school in the country. I'm also working on it via my Hawthorne-Green Institute concept... a college which is geared to the 1980s and 90s... one which will feature high-speed concentrated education in both technical matters and business. My aim is to provide the education which will bring us tens of thousands of entrepreneurs, all with electronics and computer backgrounds. Let's see *any* country get ahead of us then!

So, when someone puts me down as looking to make money, agree with them... and point out that so far I have a good record of investing that money for the benefit of amateur radio and computing... and, I hope you'll agree... for our country.

My ideas on how a college should be are spreading. I'm getting calls and visits from educators who are interested in the plan and who see it as a way to guide their schools into solvency in the next few years. With many private colleges failing, some radical change is needed. My talks on the subject in Brazil and South Africa brought great interest, with invites to come back and get together with government officials to further pursue the idea.

No, if I was into a personal fortune, one of the first things I would do would be to stop writing editorials, which I'm sure would immediately increase our circulation by about 50%. The next would be to stop my crusades, such as the very costly one twenty years ago to sell sideband to the readers—who hated it and felt that AM was the *only* way to go. Or the effort in 1969 to get amateurs interested in a little-known mode: NFM and repeaters. While I published hundreds upon hundreds of articles on repeaters and NFM, organized FM symposiums, put out a repeater bulletin, and dozens of books... the readers revolted, with about 20,000 dropping the magazine in disgust. Oh, most of 'em came back, sending me notes saying that, golly, I'd been right, sorry about that. But it was rough going for several years.

Not having a house or "family life" to take up my time, and not having a yacht, plane, horses, and dogs, I have the time to read so that I can keep up on computer technology... time to keep dozens of business projects going.. to personally use computers, video cameras... to go skiing occasionally, to travel... and even get on the air more than you might think. I have the time to write my editorials and even articles for other maga-

zines. I can get to Florida to give a talk on computers to an accounting group (expenses paid), to participate in a workshop on how to start special interest magazines (at the Folio show in New York)... to get to South Africa and address data processing professionals on the impact of microcomputers... and so on. I do have to give up some things which are important to most people in order to do what I enjoy... pursuing my goal of education for as many people as possible.

It doesn't take money to do many of the things I do—just time management. I was able to set the 10.5-GHz record for states worked with borrowed equipment because I was willing to go up a damned mountain at all hours of the day and night for skeds... freezing my galuccis off.

Of course, if I get a lot of static about getting rich, I can always find some sucker to buy me out and go for a twenty-year sail around the world, charging $50 a contact to the Honor Roll hams, and live like a king. An enterprising ham can make $50,000 a year or more that way, as we have seen in the past.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

One of the fastest growing phases of RTTY these days, at least as evidenced by the questions I receive from readers of this column, is "computerized," or at least video, RTTY. More and more, the amateur is getting away from the old grease-monger of mechanical teleprinter and turning to one of the new microcomputer systems.

One of those systems hams appear to be turning to is the new Radio Shack TRS-80C(R), the so-called "Color Computer." Based on the powerful Motorola 6809 central processing unit, the TRS-80C appeals to the ham on many levels. Until recently, however, little was available in the way of RTTY software for this computer.

Now, Clay Abrams K6AEP, an author whose works are well-known to the readers of *73*, is offering some rather nice software for the TRS-80C at reasonable prices. Appealing to both the RTTY and SSTV enthusiast, Clay has put together some rather nice packages.

For the slow-scan television (SSTV) operator, Clay has three programs of varying degrees of capability. SSTV 7.2 converts the TRS-80C to an SSTV keyboard for sending frames of five lines each consisting of six characters. The next step up is SSTV 7.3, which expands the previous system to include an SSTV keyboard, color keyboard, video mixing, and joystick graphics. His ultimate system is SSTV 7.4, which allows gray-level picture transmission and reception, color-picture reception, tape-save ability, and many other features. The cost? SSTV 7.2 is only $20, and SSTV 7.3 and 7.4 are $30 each.

Not interested in SSTV, huh? Well, Clay has a few good RTTY programs, too! His bottom-line RTTY program, RTTY 7.01, allows RTTY transmission and reception in Murray and ASCII at all common rates. Three transmit buffers, an RY buffer, and a CW identifier are also provided. All this for $20. Clay's top-line program, RTTYCW, provides RTTY transceive, CW transceive, random code groups, split-screen display, multiple buffers, and tape saving. Requiring an external demodulator and CW interface, the program sells for the lofty sum of $30.

Interested? Drop Clay a line at Clay Abrams Software, 1758 Comstock Lane, San Jose CA 95124. Be sure to mention that you read about it in RTTY Loop, OK?

Interest in older machines is still around. Chuck Euola K8YPU, of Redford Township, Michigan, is using an Altair 680b. This M6800-based computer was introduced shortly after the Altair 8800, the "original" 8080 computer. Chuck is interested in receiving RTTY with his 680b, and wonders if some of the programs published to run with other 6800 systems will work. Other than changing the I/O address, the biggest problem you may have is with the slow speed of the 680b, as the clock runs at 500 kHz, roughly one half to one quarter of most other 6800 systems. However, you might try halving the constant in a delay loop, as calculated for a 1-MHz system, and then fine tuning as necessary. The program published in this column back in July, 1978, should work reasonably well.

Not everybody likes a computer, though. I have a letter here from Richard E. Christina, in Pahrump NV, who writes, "I need a transmitter strictly for RTTY... I would like about 200 Watts, 100% duty cycle, tubes, vfo... I do not desire to use a computer at this time."

Well, Richard, first of all, let's get our apples and oranges straight. The computer, if you use one, replaces the mechanical teleprinter, not the transmitter and receiver. No matter what method you use to display the RTTY signal, from an ancient Model 12 to a Whiz-Bang 6880 Micro-Term, you still need a transmitter, receiver (or transceiver), and antenna to get on the air.

Now, to the point of your question. A look through the back issues of *73* or any other amateur radio magazine or handbook will turn up many circuit descriptions for CW transmitters. Basically, that's all a RTTY transmitter is: a CW, i.e., continuous wave, transmitter in which the frequency determining element is modified by the digital RRY information. Adding that modification to the vfo, for example, involves a simple diode-capacitor combination, called a "shift pot," that we have covered in this column several times in the past few years.

As for the teleprinter itself, finding information on this machine or that can also take some doing. I have another letter here from K. D. Hardin KC5II, out in Albuquerque NM, who recently purchased a Teletype® Model 3320 and is looking for data on hooking it up. The 3320 is the "I/O" version of the Model 33, and is a very useful machine. This machine is designed to work in a 20-mA loop, and connection is via either a nine-position terminal strip or a twenty-pin plug, located on the back of the call control unit. This is the right rear corner of the machine, as you face it. Fig. 1 is a diagram of the nine-pin strip, terminal strip 151411, at the rear of the machine.

Unfortunately, not all Model 33s are alike, and minor differences in the call control unit can lead to major difficulties in hooking the machine up. Manuals are available from several sources; see the ads in this magazine for current availability.

I have a note here from Jeffrey A. Maass K8ND, who relates that RTTY DXers will have an opportunity to add Anguilla (VP2E) to their DX totals between February 23 and March 3, 1982. A group of contesters will travel to Anguilla to participate in the ARRL CW and SSB DX contests between February 15 and March 10,1982, and will be taking along a complete RTTY station. Amateurs using the calls VP2EV (QSL to K8ND), VP2EJ (QSL to WA8CZS), and VP2ED (QSL to

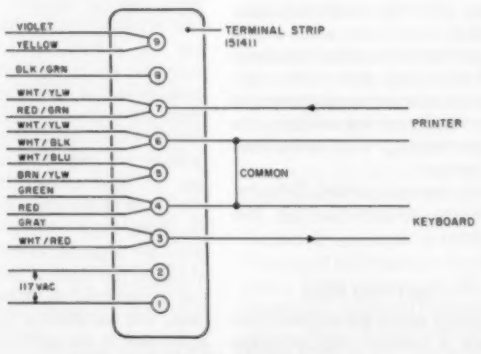


Fig. 1. Model 33 teletype hookup.

WB8VPA) will be operating in the time slot detailed above. Good luck!

By the way, the number of you interested in RTTY DXing does seem to be growing. Not only for two-way communications, but for looking for those rare press and commercial stations, too! Lt. Mike Anderson, with the U.S. Navy in Europe, is one of those folks. So I am happy to let you in on a little tip. A few months back, I mentioned Tom Harrington's book, *World Press Services Frequencies*, in this column. Available from the *73* Radio Bookshop at $5.95, this book contains listings of hundreds of commercial and governmental RTTY stations. One of the services promised by Tom was to keep buyers updated of recent "finds" and changes to the listing. Well, I have received his latest listing, and it is quite a gold mine for the individual interested in RTTY monitoring.

Well, this month brought Groundhog Day! Did the groundhog poke his head out of Baudot, see his shadow, and ASCII for six more weeks of winter? Who can say? (Murray can!) Find out here, in RTTY Loop!

NEW PRODUCTS

TEN-TEC 2-KW ANTENNA TUNER

Another first for Ten-Tec is a new 2-kW antenna tuner/swr bridge/power meter. The new tuner uses a reversible "L" configuration with a silver-plated roller inductor, high-voltage variable capacitor, and selectable fixed capacitors for greater versatility in impedance matching. The design automatically provides a low Q minimum loss path when properly adjusted. Power ratings are 2 kW PEP and 1 kW CW. Frequency range is 1.8-30 MHz. Model 229 matches conventional 50-Ohm unbalanced outputs of transceivers or linear amplifiers to a variety of balanced or unbalanced load impedances. Antennas such as dipoles, inverted "V"s, long random wires, windoms, beams, rhombics, mobile whips, Zepps, Hertz, and similar types can be matched. A built-in balun converts one antenna to a balanced configuration if desired.

The built-in swr bridge and dual-range power meter indicates swr from 1:1 to 5:1 and power from 10 to 2000 Watts.

Front-panel controls are variable capacitor with spinner knob, roller inductor with spinner knob, 11-position bypass/hi-lo capacitor select switch, 4-position antenna selector switch, swr sensitivity, forward/reverse switch, 2000/200-Watt power range switch, and swr/power meter switch.

Rear panel includes coax input connector, four coax antenna connectors, three thumbscrew-type connectors for single wire and balanced line, ground connector, and 12-V dc input for dial lighting power.

Styling matches the Ten-Tec Omni transceiver and Hercules linear amplifier with black and bronze front panel with blackout lighting, satin-finish wrap-around aluminum bezel, black textured vinyl-clad aluminum clamshell top, and bottom with fold-down stainless steel bail. Size: 6½" H × 12¾" W × 13½" D. Wt.: 9 lbs.

For full information, write *Ten-Tec, Highway 411 East, Sevierville TN 37862.*

The MFJ-401 Econo Keyer II.

The Ten-Tec 2-kW antenna tuner.

MFJ-401 AND MFJ-405 ECONO KEYER II

The MFJ-401 and MFJ-405 Econo Keyer II from MFJ Enterprises is a new full-feature economy keyer using the Curtis 8044 IC for reliability. The MFJ-401/405 Econo Keyer II has a much easier to use design and layout than the old Econo Keyer line. All controls are located on the front panel where they are easy to find and use.

The MFJ-401/405 Econo Keyer II has front-panel controls for both speed and volume. The on/off switch and auto/semi-auto switch is on the front panel. This switch lets you use the Econo Keyer II like a bug or it can be used to make tuning more convenient. A red LED indicates when the MFJ-401/405 Econo Keyer II is on. It may be used with an internal 9-volt battery or any source of 5-9 V dc. Circuitry is provided for both grid block and direct keying. This features lets the keyer work well with tube-type and solid-state rigs.

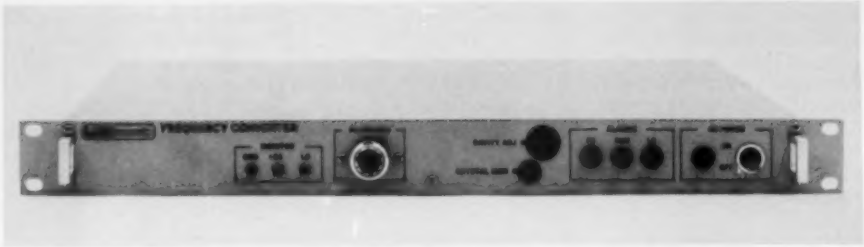
The MFJ-405 Econo Keyer II has a built-in clear lucite paddle and a jack on the back for an external iambic paddle. The MFJ-401 does not have a built-in paddle, but all other features are the same.

For more information, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 478.

LNR DOWNCONVERTER FOR SATELLITE COMMUNICATIONS

The new Model DC4-E1 is a high-performance, low-profile rf to I-f converter especially designed for small terminal satellite Earth stations. Available in single thread and redundant configurations, this unit offers low phase noise and good frequency stability for digital and voice carriers, such as QPSK and FM-SCPC. The DC4-E1 is compact, measuring only 1-3/4" in height, and is designed for 19" rack mounting. Interfaces are coax connectors, so that the signal may be carried on low-cost coaxial cable. FET LNA power on the rf input connector is available as an option.

Low translation phase noise is ensured by an internal crystal-controlled phase-locked oscillator. Additionally, designed optimization ensures minimal intermodulation distortion. Each converter module is self-contained, including power supply. The unit is designed for unattended operation and has a remotable summary alarm and front-panel monitors for key operating parameters. LNR is a



The LNR frequency converter.

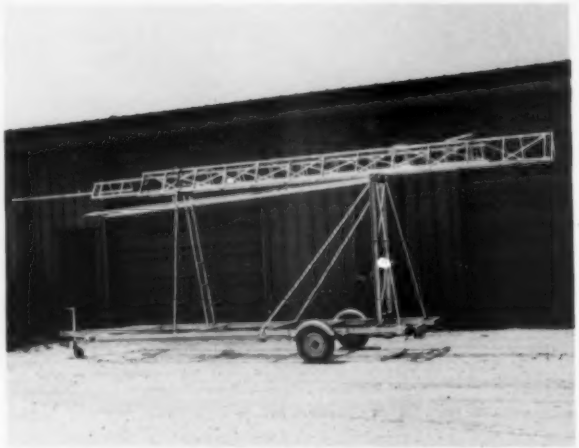
leading manufacturer of telecommunications equipment for satellite Earth stations.

For more information, please contact *LNR Communications, Inc., Marketing Department, 180 Marcus Blvd., Hauppauge NY 11787.* Reader Service number 480.

NEW TOWER TRAILER

For those special situations that require communications tower mobility, Aluma Tower Co. introduces an all-steel trailer for transporting and erecting any Aluma Tower Co. aluminum or steel tower. Ideal for Field Day, civil defense, remote signal testing and many other situations, the tower/trailer combination is easily towed. Once in place, the tower is tilted up and cranked into position. The trailer acts as a secure base.

For more information, contact *Aluma Tower Co., 1639 Old Dixie Highway, Box 2806, Vero Beach FL 32960.* Reader Service number 482.



The Aluma Tower trailer.

PORTABLE RTTY/CW TERMINAL

HAL Communications Corp. is pleased to announce the new CWR685A Telereader portable RTTY/CW terminal. Featuring compact size and 12-V dc operation, the CWR685A is just the thing for the traveling RTTY amateur who wants to "take it with him." A green phosphor 5" display is built into the small 12-3/4" × 11" × 5" main cabinet, as is a RTTY modem for 3 shifts, both "high" and "low" tones. The keyboard is separate and connects with a 3-foot cord to the main unit. Advanced features such as programmable HERE IS messages, type-ahead transmit buffer, and automatic transmit-receive control are included with the Telereader. The CWR685A can easily be slipped into a suitcase for a ham outing. In the home shack, the Telereader consumes little space and can be connected to an external monitor and parallel ASCII printer for even more versatility.

The HAL portable RTTY/CW terminal.

For more information, contact *HAL Communications Corp., Box 365, Urbana IL 61801.* Reader Service number 479.

SUPERCW

Frontier Enterprises has introduced SUPERCW, a computer-aided instruction program for the TRS-80 Model I or III microcomputer. Sound and graphics are combined to teach the user International Morse Code. By progressively increasing the copy speed, SUPERCW brings the user to 20 words per minute in as little as 72 hours of practice.

The disk-based SUPERCW package requires a 32K, 1-disk system. Features include random or plain text practice, sample testing, and provision for multiple users. For more information, contact *Frontier Enterprises, 3511 Gallows Road, Falls Church VA 22047.* Reader Service number 483.

MOBILE HT CHARGER

Mobile amateurs can operate and recharge their hand-held radios anytime with the new HT Power-Charger™ from Valor Enterprises. They simply insert the charger into the lighter socket and attach the mating plug to the radio. It will charge hand-held radios in less than an hour. The HT Power-Charger is not just a dropping resistor and diode, but a pair of transistors in a variable current regulator that is self-adjusting depending on the batteries' state of charge.

Mobile amateurs will appreciate the convenient package—all circuitry is enclosed in the plug with no box dangling on the cord. The HT Power-Charger features a built-in LED to indicate lighter socket function, with a five-foot connecting cable and plug to mate with the radio. There are six models designed to fit most popular amateur hand-held radios.

For more information, contact *Valor Enterprises, Inc., 185 W. Hamilton Street, West Milton OH 45383.* Reader Service number 481.

Valor Enterprises' mobile HT charger.

Orbit

ORBIT is the Official Journal for the Radio Amateur Satellite Corporation (AMSAT), P.O. Box 27, Washington, DC 20047. Please write for application.

For a **FREE SAMPLE COPY** please send $1 to cover First Class Postage and handling to: Orbit, 221 Long Swamp Road, Wolcott, CT 06716.

MOVING?

Let us know 8 weeks in advance so that you won't miss a single issue of 73 Magazine.
Attach old label where indicated and print new address in space provided. Also include your mailing label whenever you write concerning your subscription. It helps us serve you promptly. Write to:

73 magazine
Subscription Department
P.O. Box 931
Farmingdale NY 11737

☐ Address change only ☐ Payment enclosed
☐ Extend subscription
☐ Enter new subscription ☐ Bill me later
☐ 1 year $25.00 (Canada $27, Foreign $35/US funds)

If you have no label handy, print OLD address here.

AFFIX LABEL

Name _____ Call _____
Address _____
City _____ State _____ Zip _____

print NEW address here:

Name _____ Call _____
Address _____
City _____ State _____ Zip _____

321B6

WATCH FOR OUR NEW PRODUCTS COMING SOON

HAL 2304 MHz DOWN CONVERTERS (FREQ. RANGE 2000/2500 MHz)
2304 MODEL #1 KIT BASIC UNIT W/PREAMP LESS HOUSING & FITTINGS **$49.95**
2304 MODEL #2 KIT (with preamp) **$59.95**
2304 MODEL #3 KIT (with High Gain preamp) **$89.95**

MODELS 2 & 3 WITH COAX FITTINGS IN & OUT AND WITH WEATHER-PROOFED DIE CAST HOUSINGS.
FACTORY WIRED & TESTED ..... **$50 additional**

BASIC POWER SUPPLY **$19.95**
POWER SUPPLY KIT FOR ABOVE WITH CASE **$24.95**
FACTORY WIRED & TESTED **$34.95**

ANTENNAS & OTHER ACCESSORIES AVAILABLE. SEND FOR MORE INFO.

COMPLETE KITS: CONSISTING OF EVERY ESSENTIAL PART NEEDED TO MAKE YOUR COUNTER COMPLETE. **HAL-600A** 7-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 600 MHz. FEATURES TWO INPUTS, ONE FOR LOW FREQUENCY AND ONE FOR HIGH FREQUENCY. AUTOMATIC ZERO SUPPRESSION. TIME BASE IS 1.0 SEC OR .1 SEC GATE WITH OPTIONAL .10 SEC GATE AVAILABLE. ACCURACY ± .001%. UTILIZES 10-MHz CRYSTAL 5 PPM. **COMPLETE KIT $129**

HAL-300A 7-DIGIT COUNTER (SIMILAR TO 600A) WITH FREQUENCY RANGE OF 0-300 MHz. **COMPLETE KIT $109**

HAL-50A 8-DIGIT COUNTER WITH FREQUENCY RANGE OF ZERO TO 50 MHz OR BETTER. AUTOMATIC DECIMAL POINT. ZERO SUPPRESSION UPON DEMAND. FEATURES TWO INPUTS: ONE FOR LOW FREQUENCY INPUT, AND ONE ON PANEL FOR USE WITH ANY INTERNALLY MOUNTED HALTRONIX PRE-SCALER FOR WHICH PROVISIONS HAVE ALREADY BEEN MADE. 1.0 SEC AND .1 SEC TIME GATES. ACCURACY ± .001%. UTILIZES 10-MHz CRYSTAL 5 PPM. **COMPLETE KIT $109**

FREE: HAL-79 CLOCK KIT PLUS AN INLINE RF PROBE WITH PURCHASE OF ANY FREQUENCY COUNTER.

PRE-SCALER KITS

HAL 300 PRE ..... (Pre-drilled G-10 board and all components) **$14.95**
HAL 300 A/PRE ..... (Same as above but with preamp) **$24.95**
HAL 600 PRE ..... (Pre-drilled G-10 board and all components) **$29.95**
HAL 600 A/PRE ..... (Same as above but with preamp) **$39.95**

NEW! **HAL-1 GHz PRESCALER,** VHF & UHF INPUT & OUTPUT. DIVIDES BY 1000. OPERATES ON A SINGLE 5 VOLT SUPPLY.
PREBUILT & TESTED $79.95

TOUCH TONE DECODER KIT

HIGHLY STABLE DECODER KIT. COMES WITH 2 SIDED, PLATED THRU AND SOLDER FLOWED G-10 PC BOARD, 7-567's, 2-7402, AND ALL ELECTRONIC COMPONENTS. BOARD MEASURES 3-1/2 x 5-1/2 INCHES. HAS 12 LINES OUT. ONLY **$39.95**

NEW — 16 LINE DELUXE DECODER **$69.95**

DELUXE 12-BUTTON TOUCHTONE ENCODER KIT UTILIZING THE NEW ICM 7206 CHIP. PROVIDES BOTH **VISUAL** AND **AUDIO** INDICATIONS! COMES WITH ITS OWN TWO-TONE ANODIZED ALUMINUM CABINET. MEASURES ONLY 2-3/4" x 3-3/4". COMPLETE WITH TOUCH-TONE PAD, BOARD, CRYSTAL, CHIP AND ALL NECESSARY COMPONENTS TO FINISH THE KIT. **PRICED AT $29.95**

NEW — 16 LINE DELUXE ENCODER **$39.95**

FOR THOSE WHO WISH TO MOUNT THE ENCODER IN A HAND-HELD UNIT. THE PC BOARD MEASURES ONLY 9/16" x 1-3/4". THIS PARTIAL KIT WITH PC BOARD, CRYSTAL, CHIP AND COMPONENTS. **PRICED AT $14.95**

ACCUKEYER (KIT) THIS ACCUKEYER IS A REVISED VERSION OF THE VERY POPULAR WB4VVF ACCUKEYER ORIGINALLY DESCRIBED BY JAMES GARRETT, IN QST MAGAZINE AND THE 1975 RADIO AMATEUR'S HANDBOOK. **$16.95**

ACCUKEYER — MEMORY OPTION KIT PROVIDES A SIMPLE, LOW COST METHOD OF ADDING MEMORY CAPABILITY TO THE WB4VVF ACCUKEYER. WHILE DESIGNED FOR DIRECT ATTACHMENT TO THE ABOVE ACCUKEYER, IT CAN ALSO BE ATTACHED TO ANY STANDARD ACCUKEYER BOARD WITH LITTLE DIFFICULTY. **$16.95**

BUY BOTH THE MEMORY AND THE KEYER AND **SAVE**. COMBINED PRICE ONLY **$32.00**

PRE-AMPLIFIER

HAL-PA-19 WIDE BAND PRE-AMPLIFIER, 2-200 MHz BANDWIDTH (−3dB POINTS). 19 dB GAIN. **FULLY ASSEMBLED AND TESTED $8.95**

NEW! **CLOCK KIT — HAL 79 FOUR-DIGIT SPECIAL — $7.95.** OPERATES ON 12-VOLT AC (NOT SUPPLIED). PROVISIONS FOR DC AND ALARM OPERATION.

6-DIGIT CLOCK • 12/24 HOUR

COMPLETE KIT CONSISTING OF 2 PC G-10 PRE-DRILLED PC BOARDS, 1 CLOCK CHIP, 6 FND COMM. CATH. READOUTS, 13 TRANS., 3 CAPS., 9 RESISTORS, 5 DIODES, 3 PUSH-BUTTON SWITCHES, POWER TRANSFORMER AND INSTRUCTIONS. DON'T BE FOOLED BY PARTIAL KITS WHERE YOU HAVE TO BUY EVERYTHING EXTRA. **PRICED AT $12.95**

CLOCK CASE AVAILABLE AND WILL FIT ANY ONE OF THE ABOVE CLOCKS. REGULAR PRICE $6.50. **BUT ONLY $4.50 WHEN BOUGHT WITH CLOCK.**

SIX-DIGIT ALARM CLOCK KIT FOR HOME, CAMPER, RV, OR FIELD-DAY USE. OPERATES ON 12-VOLT AC OR DC, AND HAS ITS OWN 60-Hz TIME BASE ON THE BOARD. COMPLETE WITH ALL ELECTRONIC COMPONENTS AND TWO-PIECE, PRE-DRILLED PC BOARDS. BOARD SIZE 4" x 3". COMPLETE WITH SPEAKER AND SWITCHES. IF OPERATED ON DC, THERE IS NOTHING MORE TO BUY.* **PRICED AT $16.95**

*TWELVE-VOLT AC LINE CORD FOR THOSE WHO WISH TO OPERATE THE CLOCK FROM 110-VOLT AC. **$2.50**

SHIPPING INFORMATION: ORDERS OVER $25 WILL BE SHIPPED POSTPAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN $25, PLEASE INCLUDE ADDITIONAL $2.00 FOR HANDLING AND MAILING CHARGES. SEND 20¢ STAMP FOR FREE FLYER.

DISTRIBUTOR FOR
Aluma Tower • AP Products
(We have the new Hobby-Blox System)

"HAL"
HAROLD C. NOWLAND
W8ZXH

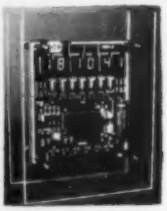
HAL-TRONIX
P. O. BOX 1101
SOUTHGATE, MICH. 48195
PHONE (313) 285-1782

See List of Advertisers on page 114

CLOCKS & KITS

SEE THE WORKS CLOCK

Our Easiest Clock To Assemble



Model 850

Six digits LED clock. 12 or 24 hour format. Attractive clear plexiglas stand. Kit is complete including pre-cut and drilled plexiglas stand and all hardware. Size: 6" H x4-1/3" W x 3" D
Model 850 ..... **$29.95**
Model 850 WT (Factory wired & tested) **$39.95**
Now available with GREEN LEDs
Model G850 ..... **$39.95**
Model G850WT (Factory wired & tested) **$49.95**
(10% off if you buy 3 or more)

6 DIGIT CLOCK KIT

12 or 24 hour format. Six large .5" digits. 50/60 hz operation. Kit is complete with attractive plexiglas cabinet.
Model 5314 ..... **$29.95**

Model 5314

MOBILE CLOCK KIT

Model 2001

6 Digit LED display. 12 or 24 hour format. Will operate 12 VDC or 12 VAC. Accurate crystal time base. LED display turns off and on with ignition if desired. Kit is complete with cabinet and 4 way mounting bracket.
Model 2001R **$29.95**
($27.95 in qtys. of 3 or more)

60 HZ CRYSTAL TIME BASE

Enable your digital clocks to run on DC power.
Model TB-1 ..... **$4.95**
Model TB-1WT (wired & tested) **$9.95**

VEHICLE INTRUSION ALARM

Easy to assemble and install, this kit offers options not normally found in other alarm systems. Hidden switch mounts under the dash. Kit has provision of sensors and remote control switch. Programmable time delays for exit, entry and alarm periods. Basic hook-up utilizes the dome light circuit activating when doors are opened. The alarm will drive a siren or pulse horn at a 1 HZ rate. Not prone to false alarms due to reliable CMOS circuitry. No external switch required. Complete kit with easy to follow instructions and diagrams.
Model ALR-1 ..... **$14.95**
Model ALR-1WT (wired & tested) **$24.95**

(10% off if you buy 3 or more)

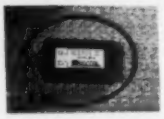
TERMS: US & Canada add 5% shipping, handling & insurance. Foreign orders add 10% (20% airmail). Orders under $20.00 add $1.50 extra handling. COD add $2.00. Visa/Mastercard welcome. Ohio residents add 4½% sales tax.

Prices subject to change without prior notice. ↩307

DEBCO ELECTRONICS
P. O. BOX 9169 DEPT. K
CINCINNATI, OHIO 45209
Phone: (513) 531-4499

BEEPER III

The Professional Touch Comes to Amateur Radio!



- BP-3 produces a gentle (adjustable) high beep to indicate key-down, a low beep to indicate key-up!
- Perfect for low band use, during nets, emergencies, and under noisy conditions!
- Great for VHF, UHF, an essential for any repeater!
- Simple hook-up! BP-3 plugs into your rig's mic connector; your mic plugs into BP-3!
- Designed for instant hook-up to the standard 4-pin mic connector; easily modified with supplied details!
- Works with any radio where PTT line is grounded to XMT. Virtually all modern gear!
- State-of-the-art CMOS circuitry for low power operation. RF proof!
- One 9-volt battery (not included) powers BP-3 for up to one year!
- Small, compact construction: 2-3/8" x 4-3/8" x 1-7/32"
- Available "board only" for custom or repeater use. Commercial quality!

BP-3A: case, cable, standard 4-pin connectors..... $39.95 ppd
BP-3B: same as above, without connectors..... $36.95 ppd
BP-3C: circuit board only, for custom installations.... $29.95 ppd

All models are assembled/tested and carry a 90 day limited warranty. We ship FIRST CLASS/INSURED and we PREPAY shipping in the U.S. *Dealer inquiries invited.* Ohio residents please add 5% sales tax. Check or money order only.

FAXSCAN INC.

3148 Dorf Drive,
Dayton, Ohio 45418

↩85

Two-meter H.T. Amplifier Kit

$56.95 PPD. USA

1.5 watts in—20 out
COR BNC in—SO-239 out
small size: 1-3/16" x 3" x 4-1/2"
Class C or AB1

ask about our other UHF & VHF amplifier kits

↩459

QRO ENGINEERING

1398 Edwards Ave.
Lakewood, OH 44107
(216) 221-9500

APARTMENT BLUES?
Get on the air NOW!
with
HANDBOOK OF APARTMENT OPERATION
by Dan Fox, W2IQD.
Everything you need to know about operating from these tough spots. Over 150 fact-filled pages cover every aspect of apartment/condo operation.
MONEYBACK GUARANTEE
only $12.50 + $1.50 p&h Check, MC, VISA (card#-date)
to Wessex Publishing Co. Dept. B9
POB 175 N. Chelmsford, MA. 01863

UNSCRAMBLE

SCANNER ACCESSORIES
FREE LITERATURE
501-623-6027

DNE, INC., RT. 7, BX257 ↩43
HOT SPRINGS, ARK. 71901

POLICE CODE

HAM HELP

I am in need of a schematic or instruction manual for a MARC multiband radio receiver. I will pay copying and mailing expenses.

Scognamiglio Vincenzo
Piazza Trieste e Trento, 17
80046 S. Giorgio A Cremano
Naples, Italy

I am in need of information on the Galaxy V MK3, conversion details for an Aerotron transceiver, and information on interfacing a TRS-80 to a Model 15 printer via an M-80 interface.

Tom Van Schuyler WA2LOJ
57 Needle Lane
Levittown NY 11756

I am in need of manuals for a Gonset 3136, an Ameco 50-220-MHz vfo, and a Seco 520 antenna tester.

Orlo Taylor WA8HWM
18412 N. 148th Ave.
Spring Lake MI 49456

I need help interfacing a DEC (Digital Equipment Corp.) dot matrix printer, LA-30 (1972 vintage). I have no schematic or configuration info, and can't seem to shake one loose anywhere. I will pay for copies and postage.

Stephen F. Gent WB2VKL
Berry Rd
Fredonia NY 14063

I am in need of a service manual or wiring diagram for a Hallicrafters S120A receiver. I will copy your original and return it to you.

Bill Suffich W4UUC
55 So. Carlen St.
Mobile AL 36606

I would like to phone QSO with anyone into weather fax recording.

Dante Ventriere KA4JRE
17831 NW 81 Ave.
Miami FL 33015

MILITARY SIGNAL GENERATORS
RECONDITIONED AND LAB CALIBRATED

TS-510/U RANGE 10 MHZ THRU 420 MHZ AM/CW OR PULSE MODULATION. CALIBRATED ATTENUATOR, MILITARY EQUIVALENT TO HP608D $ 375.00
TS-621/URM-52, RANGE 3.8 TO 7 GHZ, AM/PULSE MODULATION, CALIBRATED ATTENUATOR, MILITARY EQUIVALENT TO HP618A 345.00
HP606A, RANGE 50 KHZ THRU 50 MHZ AM/CW, CALIBRATED ATTENUATOR 450.00
HP612A, RANGE 450 THRU 1230 MHZ, AM/PULSE MODULATION, CALIBRATED ATTENUATOR 475.00
HP614, RANGE 900 THRU 2100 MHZ AM/PULSE MODULATION, CALIBRATED ATTENUATOR 345.00
URM-25, RANGE 10 KHZ THRU 50 MHZ AM/CW, MODULATION 400 & 1 KHZ, CALIBRATED OUTPUT, PRECISION 50 OHM STOP ATTENUATOR 285.00
URM-26, RANGE 4 MHZ THRU 405 MHZ AM/CW MODULATION, CALIBRATED ATTENUATOR 285.00
TS-497/URR, RANGE 2 MHZ THRU 50 MHZ CALIBRATED ATTENUATOR, AM/CW MODULATION, MILITARY VERSION OF MEASUREMENTS MODEL 80 225.00
SG-13/U, AIRCRAFT VOR/ILS, RANGE 108 THRU 135.9 MHZ AND 329.9 TO 335 MHZ, OUTPUT SIGNALS INCLUDE VOR, LOC, GLIDESLOPE AND 1000 CPS. SAME AS COLLINS 479T-2. OPERATES FROM 28 VDC AT 3½ AMPS BENCH POWER SUPPLY OR AIRCRAFT BATTERIES. IDEAL FOR AIRCRAFT RADIO REPAIR 295.00
SG1A/ARN, AIRCRAFT RADIO SIG GEN WITH PP-348/ARN 115V/60 HZ P/S, RANGE 88 THRU 140 MHZ AND 110.1 TO 114.9 MHZ IN 10 KHZ STEPS. CALIBRATED OUTPUT 400/1000 HZ. MODULATION INT OR EXT, MILITARY EQUIVALENT TO BOONTON 211A 345.00
SG-12/U, RANGE 20 MHZ THRU 100 MHZ, METERED RF OUTPUT 0-5V METERED DEVIATION 0-100 KHZ. PERFECT FOR LOW BAND FM RADIO SERVICING OR USE TO REPAIR YOUR PRC. GRC, VRC, FM RADIOS 165.00
ABOVE SIGNAL GENERATORS ARE OF EXCELLENT QUALITY, BUILT TO MIL/SPECS
OS-121/USM-140, OSCILLOSCOPE WITH MX3078/USM HORIZ CHANNEL PLUG-IN AND MX-2930 DUAL TRACE PLUG-IN, 5"CRT, INTERNAL SWEEP, 24 CALIBRATED RANGES WITH SWEEP EXPANSION, TRIGGER MODES, CALIBRATOR, DC-22MHZ, HOUSED IN VENTED AIR COOLED CABINET, SIZE 22"L x 14"H x 19"W, A BEAUTIFUL MILITARY OSCILLOSCOPE AT A GOOD LOW PRICE 295.00
TS-28/U TELETYPEWRITER TEST SET 49.00
HP803 VHF BRIDGE 75.00
SIERRA 126B FREQUENCY SELECTIVE VOLTMETER 95.00
HP415B STANDING WAVE INDICATOR 45.00
UPM-6B RADAR TEST SET 125.00
URM-32A FREQUENCY METER 125KHZ THRU 1000 MHZ 85.00
HP741A AC/DC DIFFERENTIAL VOLTMETER DC STANDARD 345.00
FOB OTTO N.C., 30 DAY MONEY BACK GUARANTEE
WE ACCEPT M/C, VISA OR CHECK. PHONE BILL SLEP (704) 524-7519

Slep Electronics Company
P. O. BOX 100, HWY 441, DEPT. 73
OTTO, NORTH CAROLINA 28763
Electronic Distributors
367

WORK THE U.H.F. BANDS
Add a transverter or converter to your existing 10m, 6m or 2m equipments. Choose from the largest selection of modules available for DX, OSCAR, EME, ATV.

TRANSVERTERS

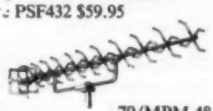
MMT 50-144 $234.95
MMT 144-28 $219.95
MMT 432-28 (S) $319.95
MMT 439-ATV $379.95
MMT 1296-144 $399.95
OTHER MODELS AVAILABLE

CONVERTERS
Choose from many models to suit your needs.
Examples: MMC 432-28, MMC 426/439—ATV
MMK 1296-144, MMC 1280—ATV
Write for details and available options.

FILTERS

Prevent OSCAR 8 Mode J desense
Use MMF200-7 $42.95
Stop receiver IMD birdies
Use PSF432 $59.95

ANTENNAS
420-450 MHz J-beams
48 el. 15.7 dBd $75.75
88 el. 18.5 dBd $105.50



70/MBM 48

1250-1300 MHz loop yagi 1296-LY $49.75
Send 36¢ stamps for full details of all our VHF/UHF items.
Pre-selector filters
Low-pass filters
Varactor triplers
Pre-amplifiers
Transverters
Converters
Antennas
Crystal Filters

VISA master charge

Spectrum International, Inc.
Post Office Box 1084S
Concord, Mass. 01742 USA
436

DOLLAR SAVER/SPACE SAVER
WELZ SP-300 SWR & POWER METER
1.8 to 500 MHZ/1 W to 1 KW

Exclusive cross over frequency range
3 Transmitter/3 Antenna Connectors.
One SWR/Power for the serious amateur who operates all bands, HF to 450 MHz

Serious Dealers Listing Available.

NCG
318

1275 N. Grove St.
Anaheim, Cal. 92806
(714) 630-4541

NOTE: Price, Specifications subject to change without notice and obligation.

See List of Advertisers on page 114

Hi Pro Mk II

LB-VHF-UHF REPEATERS SOON TO BE FCC TYPE ACCEPTED

—NEW—

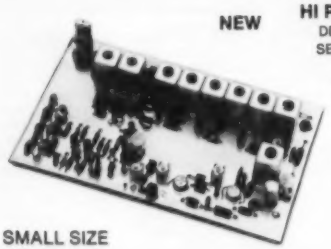
NEW SUPERIOR RECEIVER AND TRANSMITTER SPECIFICALLY DESIGNED FOR REPEATER SERVICE. ADJUSTABLE TRANSMITTER POWER, FROM 1 TO 25 WATTS MINIMUM OUTPUT WITH EXTREMELY COOL OPERATION. —AUTOMATIC BATTERY BACK UP SYSTEM CAPABILITY WITH BATTERY CHARGING AND REVERSE POLARITY PROTECTION.—NOW WITH A FULL COMPLIMENT OF INDICATORS AND STATUS LIGHTS. 100% DUTY CYCLE—ADVANCED REPEATER SQUELCH SYSTEM NO CHOPPING, POPPING, OR ANNOYING REPEATER KEY UPS DURING LIGHTNING STORMS.—DIE CAST ALUMINUM R.F. ENCLOSURES—SMALL SIZE 5¼ X 19 X 13"—HIGH QUALITY LONG LIFE DESIGN.

— AMATEUR DISCOUNTS AVAILABLE—

Hi Pro RECEIVER and TRANSMITTER

NOW USED IN ALL HI PRO REPEATERS
ALSO AVAILABLE IN KIT FORM

NEW



SMALL SIZE
3-7/8 x 6-1/8"

HI PRO TRANSMITTER
DESIGNED FOR REPEATER SERVICE WITH EXCELLENT AUDIO, STABILITY, HARMONIC REJECTION, AND LOW SIDEBAND NOISE.

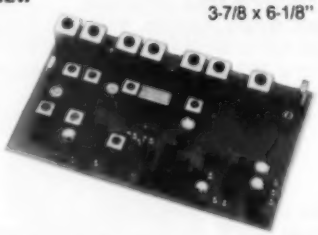
ADJUSTABLE POWER OUTPUT— UP TO 5 WATTS FROM THE EXCITER BOARD COOL OPERATION

THIS EXCITER IS USED TO DRIVE THE HI PRO 25 WATT POWER AMPLIFIER AND IS AVAILABLE KIT OR ASSEMBLED.

HI PRO RECEIVER
THIS RECEIVER IS THE HEART OF THE REPEATER AND BOASTS SUPERIOR SQUELCH ACTION NEEDED FOR THIS TYPE OF SERVICE. EXCELLENT SENSITIVITY, STABILITY AND SELECTIVITY

USE THIS RECEIVER TO REPLACE THAT TROUBLESOME RECEIVER IN YOUR PRESENT REPEATER.

NEW



SMALL SIZE
3-7/8 x 6-1/8"

WRITE FOR COMPLETE SPECIFICATIONS ON OUR FULL LINE OF ACCESSORIES AND LOWER COST REPEATERS.

46

MAGGIORE ELECTRONIC LAB.

590 SNYDER AVE.
WEST CHESTER, PA. 19380 PHONE 215-436-6051

Universal Communications
A DIVISION OF INNOVATIVE LABS, INC.
P.O. BOX 339
ARLINGTON, TEXAS 76004-0339

SUPERVERTER I.....$99.95
The ultimate in converter technology! Dual-stage selective preamp, mixer, i.f. amplifier and no-drift crystal-controlled oscillator. We recommend this unit **for experienced kit builders.** 12v Stationary Power Supply...$24.95 for Superverter I.

SELECTIVE PREAMP.....$44.50
This new unit is not like other wideband preamps. Experienced kit builders can easily add this unit to our existing boards or to other manufacturers' boards to improve overall performance.

2300 MHZ CONVERTER KIT.....$35.00
Complete with PC board, parts and 10-page instruction book.

VARIABLE POWER SUPPLY.....$24.95
Complete kit includes all components for working unit, including deluxe box and overlays.

DISK YAGI ANTENNA.....$25.00
Complete kit with PVC and mounting bracket. Stronger than loop yagi, and equal in gain.

4-FOOT DISH ANTENNA.....$54.95
Overall 25 dB gain. Partial assembly required. Shipped UPS (ground) only.

DL-2000 SATELLITE RECEIVER.....$749.95
Fully assembled receiver—this is not a kit.

120° LNA.....$650.00

TERMS: COD, Money Order, Bank Cards (800) 433-5172 ORDERS ONLY
HOURS: 8:30-4:30 CDST; MON-FRI (817) 265-0391 INFORMATION

Hope to see you in Miami

Our product may be copied, but the performance is never equalled.

UNIVERSAL COMMUNICATIONS

P.O. BOX 339, ARLINGTON, TX 76004-0339

AN OASIS IN A SEA OF TECHNICAL JARGON

Are you on the verge of drowning in the flood of technical information about computers in the marketplace? Wayne Green Inc. can help! **Desktop Computing** is here, and each month will explain all about computers without the "computerese."

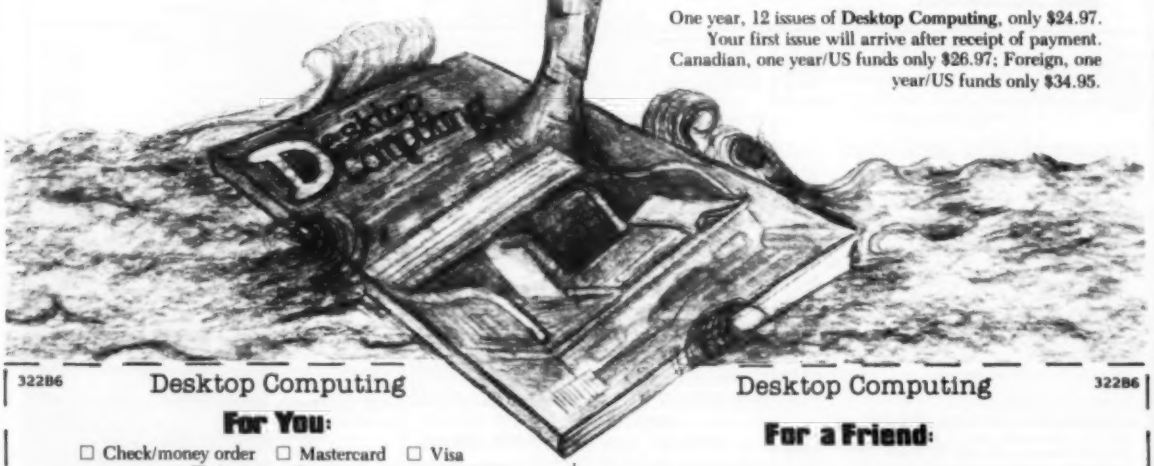
Desktop Computing will cut through the technical hocus-pocus to bring you all the information you need to take advantage of the computer age. Thousands of businessmen, like yourself are saving an amazing amount of money as they find out that computers do things faster, provide access to more information, and allow a smaller staff to do more work. You can provide more services at a lower cost than you have ever been able to do before. Now is the time for you to get in on the savings with the "plain language" information that only **Desktop Computing** can offer you.

The real bargain is that all the "plain language" information you need about computers is available for only $24.97 for a 12 issue, year subscription that is tax deductible!

To order, fill in the coupon below. A photocopy of the coupon is acceptable. Introduce your friends to **Desktop Computing**—it makes a great gift! We accept Mastercard, Visa, American Express and personal checks or money orders. If you're not delighted with **Desktop Computing**, we'll refund the unused balance of your subscription. Take advantage of this no-risk offer today. After all, how often does your own personal oasis come along?

Mail coupons to:
Desktop Computing
Subscriptions
Box 917
Farmingdale, NY 11737

One year, 12 issues of **Desktop Computing**, only $24.97. Your first issue will arrive after receipt of payment. Canadian, one year/US funds only $26.97; Foreign, one year/US funds only $34.95.



322B6 Desktop Computing

For You:

☐ Check/money order ☐ Mastercard ☐ Visa
☐ American Express

Name _____

Address _____

City _____ State _____ Zip _____

Signature _____ Exp. Date _____

Card # _____ Interbank # _____

Box 917, Farmingdale, NY 11737

Desktop Computing 322B6

For a Friend:

Please enter a subscription as my gift to:

Name _____

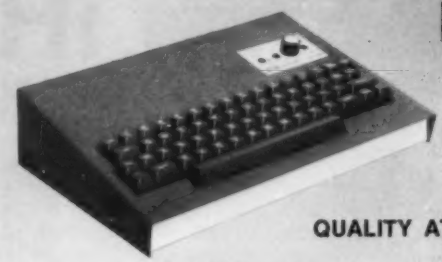
Address _____

City _____ State _____ Zip _____

☐ I DO ☐ DO NOT WANT A GIFT CARD ENCLOSED IN MY NAME.

PLEASE SEND IN BOTH COUPONS WHEN ORDERING FOR A FRIEND.

See List of Advertisers on page 114



MORSE RTTY ASCII

QUALITY AT AN AFFORDABLE PRICE

MKB-2000

- Complete set of alphanumeric, punctuation, and special function keys CQ,DE,BK,KN,SK,AR,AS,BT
- 500 character text buffer with BREAK feature
- 10 reprogrammable 40 character message memories
- 1-199 WPM, Weight & Interchar. space, Random Code
- Built-in 110 VAC power supply
- Buffer/Memory fullness indicators
- 1 year warranty on parts and labor
- Attractive anodized brushed aluminum and gray wrinkle finish case, only 13.3 x 9.4 x 3.5 in.
- RTTY/ASCII option includes—"Brag Tape" interface, CW ID, QBF and RY test messages, auto CR/LF and LTR/FIG shift 60,66,75,100,132 WPM Baudot 110,300 baud ASCII
- Other options—Memory expansion, AFSK modulator

MKB-2000 (Morse Only) **$319.00**
RTTY/ASCII Option **50.00**

MVD-1000

- Copies Morse Code directly from your receiver
- Automatic speed tracking with self calibration
- 6-60 WPM speed range
- Manual speed tracking to give operator more control
- Active filters and digital sampling for increased noise rejection
- Operates with any TV set, no expensive monitor needed
- Two page display with 16 lines of 32 characters per page
- Attractive anodized brushed aluminum and gray wrinkle finish case, only 3 x 10 x 10 in.
- RTTY/ASCII option includes demodulator

MVD-1000 (Morse Only) **$369.00**
RTTY/ASCII Option **80.00**

Add $5.00 per unit for shipping U.S.A.

Send For Free Information

DGM ELECTRONICS, INC.

787 BRIAR LANE, BELOIT, WISCONSIN 53511 (608) 362-0410

ege, inc

ORDER TOLL FREE

FEBRUARY SALE

1-800-336-4799

ORDER HOURS: 11 am - 8 pm M-F
9 am - 4 pm Saturday

Bonus: 2% Discount for Prepaid Orders
(Cashier's Check or Money Order)

VISA

Closed Tuesdays

TEN-TEC SPECIALS

515 Argonaut HF XCVR 399.95
525 Argosy HF XCVR 469.00
580 Delta HF XCVR 748.95
546 Omni-C HF XCVR 1040.00

TEN-TEC Accessories in stock at discount prices

MFJ PRODUCTS (Call for other MFJ items)

989 New 3KW Tuner 287.75
962 1.5K/V Tuner mtr/switch 199.95
949B 300 watt deluxe tuner 122.00
941C 300 watt tuner switch/mtr 78.42
940 300 watt tuner switch/mtr 69.70
484 Grandmaster memory keyer 12 msg 121.72
482 4 msg Memory keyer 87.96
422 Pacesetter Keyer w/Bencher BY1 ..... 87.15
408 Deluxe Keyer with speed mtr 69.69
496 Keyboard II 296.95
752B Dual turnable filter 78.42
102 24-hour clock 30.95

DAIWA/MCM

CN 520/CN 540 Watt Meters 59.95/69.95
CNW418/CNW518 Antenna Tuners 169.95/279.95
CNA 2002 Auto 2.5W Tuner 399.95

ASTRON POWER SUPPLIES (13.8 VDC)

RS7A 5 amps continuous, 7 amp ICS 48.60
RS12A 9 amps continuous, 12 amps ICS 66.35
RS20A 16 amps continuous, 20 amps ICS 87.20
RS20M same as RS20A + meters 105.50
RS35A 25 amps continuous, 35 amp ICS 131.95
RS35M same as RS35A + meters 151.95

MINIQUAD HQ-1 ..... 129.95
ALLIANCE HD73 Rotor 91.95
CDE HAM IV ROTOR 169.95

VoCom Antennas/2m Amps

5/8 wave 2m hand held Ant 19.95
2 watts in, 25 watts out 2m Amp 69.95
200 mw in, 25 watts out 2m Amp 82.95
2 watts in, 50 watts out 2m Amp 105.95

MIRAGE AMPS & WATT METERS

MPI HF/MP2 VHF SWR/Watt Meter ..... CALL
B23 2 in, 30 out, All Mode ..... CALL
B108 10 in, 80 out, All Mode, Pre-Amp ..... CALL
B1016 10 in, 160 out, All Mode, Pre Amp .. 235.95

BENCHER PADDLES Black/Chrome 35.25/42.95
BUTTERNUT *NEW!* HF6V 10-80m Vertical .... CALL

SUPER SPECIALS

AEA Isopole Ant., Keyers, Code Readers ..... CALL
ASTRON POWER SUPPLIES
VS35M 25 amp continuous adjustable 171.00
VS20M 16 amp continuous adjustable 124.00
AZDEN PCS 300 handheld, 2m 289.95
PCS 3000 2m XCVR with Tone Kit .. 284.00
SANTEC H71200 2m handheld 279.00
S7-7/7 440-450 handheld 284.00
***NEW* SANTEC** 2m & 440 MHz handhelds. Call for Quotes
KDK FM 2025A 269.95

BIG DISCOUNTS

KENWOOD, ICOM, YAESU, AZDEN, KDK
— Call for our quote —

HY-GAIN ANTENNAS

NEW! TH7DXX Triband Beam ..... CALL
TH3MK3 3-Element Beam 179.95
TH3JR 3-Element Triband 138.95
18AVT/WB 10-80 Vertical 82.95
14AVQ/WB 10-40 Vertical 50.77

CUSHCRAFT (other antennas in stock)

A4 New Triband Beam 10-15-20m 205.95
A3 New Triband Beam 10-15-20m 165.95
AV3 New 10-15-20m Vertical 41.50
ARX 2B New Ringo Ranger 2m 33.95
A32-19 2m "Boomer" DX Beam 75.95
220B 220 MHz "Boomer" 68.95
214B Jr. Boomer 144-146 MHz 61.95
214FB Jr. Boomer 144.5-148 MHz 61.95
A147-11 11-Element 2m 34.50

TELEX HEADSETS-HEADPHONES

C1210/C1320 Headphones 22.95/32.95
PROCOM 200 Headset/dual Imp. MIC 77.50
PROCOM 300 lt/wt Headset/dual Imp. mic 69.95

CABLE RG8/U Foam 95% Shield ..... 26¢/ft.
8 wire Rotor 2 #18, 6 #22 ..... 18¢/ft.

KLM ANTENNAS (other antennas in stock)

KT34A 4-Element Triband Beam 320.75
KT34XA 6-Element Triband Beam 469.50
144-148 13LB 2m 13-Element with balun 77.95
144-148 16C 2m 16-Element for oscar 93.55
420-450 14 420-450 MHz 14-element beam 37.54
420-450 18C 420-450 MHz 18-element oscar 58.70
432 16LB 16 elem. 430-434 MHz beam/balun 60.70

HUSTLER 5BTV 10-80m Vertical 92.50
4BTV 10-40m Vertical 73.95
3TBA New 10-15-20m Beam 188.95

HF Mobile Resonators	Standard	Super
10 and 15 meter	7.95	12.50
20 meters	10.95	14.95
40 meters	12.50	17.30
75 meters	13.50	27.95

Avanti AP 151.3G 2m on glass ant. 27.95

ORDER INFORMATION

Orders: **1-800-336-4799**
Information and Virginia orders: **(703) 643-1063**
Store Hours: **M-W-F: 12 noon-8 pm**
Saturday: 9 am-3 pm

Mailing Address: 2410 Drexel St.
Woodbridge, VA 22192
Store Location: 14415 Jefferson Davis Hwy.
Woodbridge, VA 22191

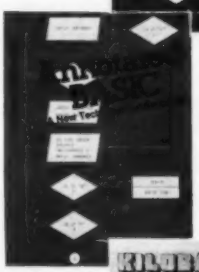
↩453

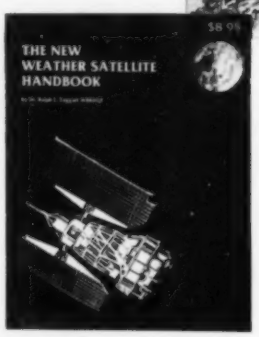
— CALL FOR QUOTES —

Send stamp for a flyer. Terms: Prices do not include shipping. VISA and Master Charge accepted. 2% discount for prepaid orders (cashier's check or money order). COD fee $2.00 per order. Prices subject to change without notice or obligation.

Wayne Green Books

NEW ARRIVALS





Annotated BASIC—A New Technique for Neophytes.

BASIC programming was supposed to be simple—a beginner's programming language which was so near to English that it could be easily understood. But, in recent years, BASIC has become much more powerful and therefore much more difficult to read and understand. BASIC simply isn't basic anymore.

Annotated BASIC explains the complexities of modern BASIC. It includes complete TRS-80* Level II BASIC programs that you can use. Each program is annotated to explain in step-by-step fashion the workings of the program. Programs are flowcharted to assist you in following the operational sequence. And—each chapter includes a description of the new concepts which have been introduced.

Annotated BASIC deals with the hows and whys of TRS-80 BASIC programming. *How* is a program put together? *Why* is it written that way? By observing the programs and following the annotation, you can develop new techniques to use in your own programs—or modify commercial programs for your specific use.

Annotated BASIC Volume 1 contains Projecting Profits, Surveyor, Things to Do, Tax Shelter, Introduction to Digital Logic, Camelot, The Soundex Code, Deduction, Op Amp, Contractor Cost Estimating. (available November) **BK7384 $10.95** ISBN 0-88006-028-X

Annotated BASIC Volume 2 contains Rough Lumber List, Trip Mileage, Flight Plan, OSCAR Data, SWR/Antenna Design, Supermaze, Petals Around the Rose, Numeric Analysis, Demons, Air Raid, Geography Test, Plumbing System Design. (available February) **BK7385 $10.95** ISBN 0-88006-037-9

Order Both Volumes and Save! **BK738402 $18.95**

Kilobaud Klassroom—
A practical course in digital electronics
by George Young and Peter Stark

Learning electronics theory without practice isn't easy. And it's no fun to build an electronics project that you can't use. *Kilobaud Klassroom*, the popular series first published in *Kilobaud Microcomputing*, combines theory with practice. This is a *practical* course in digital electronics. It starts out with very simple electronics projects, and by the end of the course, you'll construct your own working microcomputer!

Authors Young and Stark are experienced teachers, and their approach is simple and direct. Whether you're learning at home or in the classroom, this book provides you with a solid background in electronics—and you'll own a computer that you built yourself!

Kilobaud Klassroom contains Getting the Ball Rolling, Gates and Flip-Flops Explained, J.K. Flip-Flops and Clocked Logic, PC Boards and Power Supplies, Hardware Logical Functions, Voltage, Current and Power Supplies, Transistors, Diodes and OP Amps, Pulses and More Pulses, Counters and Registers, Bus Traffic Control, ROM and RAM Memories, I/O Circuitry, Parallel and Serial I/O Ports, Computer I/O III, Computer I/O IV, Computer I/O V, Processor Connections, Finally...The Kilobaud Krescendo, Eproms and Troubleshooting, Expansions and Programming, Machine-Language Programming, Assembly-Language Programming, Connecting to the Outside World.

ISBN 0-88006-027-1 (available December) **BK7386 $14.95**

The New Weather Satellite Handbook
By Dr. Ralph E. Taggart WB8DQT

Here is the completely updated and revised edition of the best-selling *Weather Satellite Handbook*—containing all the information on the most sophisticated spacecraft now in orbit. Dr. Taggart has written this book to serve both the experienced amateur satellite enthusiast and the newcomer. The book is an introduction to satellite watching that tells you how to construct a complete and highly effective ground station. Not just ideas, but solid hardware designs and all the instructions necessary to operate the equipment are included. An entire chapter is devoted to microcomputers and the Weather Satellite Station. And for the thousands of experimenters who are operating stations, *The New Weather Satellite Handbook* details all the procedures necessary to follow the current spacecraft.

Weather Satellite contains Operational Satellite Systems, Antenna Systems, Weather Satellite Receivers, A Cathode Ray Tube (CRT) Monitor for Satellite Picture Display, A Direct-Printing Facsimile System for Weather Satellite Display, How to Find the Satellite, Test Equipment, Microcomputers and the Weather Satellite Station, Station Operations.

ISBN 0-88006-015-8 available now! **BK7383 $8.95**

*TRS-80 is a trademark of Radio Shack Division of Tandy Corp.

FOR TOLL-FREE ORDERING CALL 1-800-258-5473
WAYNE GREEN BOOKS ● PETERBOROUGH NH 03458

Use the order card or itemize your order on a separate piece of paper and mail to Wayne Green Book Att: Sales ● Peterborough NH 03458.
Be sure to include check or detailed credit card information. (Visa, Master Card or American Express accepted.)
No C.O.D. orders accepted. All orders add $1.50 for first book, $1.00 each additional book, $10.00 per book foreign airmail.
Please allow 4-6 weeks after publication for delivery. Questions regarding your order? Please write to Customer Service at the above address.

From 73 = MAGAZINE

THE MOST UP-TO-DATE REPEATER ATLAS AVAILABLE!

WORLD Repeater ATLAS Repeater Repeater Repeater

INCLUDES:

- *LISTINGS BY STATE AND COUNTRY*
- *LISTINGS BY FREQUENCY*
- *MAPS FOR EACH STATE*
- *28 MHZ THROUGH 1296 MHZ*
- *PERFECT FOR MOBILING*

•WORLD REPEATER ATLAS—BK7315—Completely updated, over 230 pages of repeater listings are indexed by location and frequency. More than 50 maps pinpoint 2000 repeater locations throughout the USA. Foreign listings include Europe, the Middle East, South America and Africa. $4.95.

IN STOCK AND READY TO SHIP

*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop • Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. Add $1.50 handling charge for the first book; $1.00 for each additional book. Questions regarding your order? Please write to Customer Service at the above address. Please allow 4-6 weeks for delivery.

FOR TOLL FREE ORDERING CALL 1-800-258-5473

NEW From 73 MAGAZINE

THE 1982 EDITION

GENERAL LICENSE STUDY GUIDE

by Timothy M. Daniel N8RK

This is the complete guide to the General License. Learning rather than memorizing is the secret. This is not a question-and-answer guide that will gather dust when the FCC issues a new test. Instead, this book will be a helpful reference, useful long after a ham upgrades to General. Includes up-to-date FCC rules and an application form.

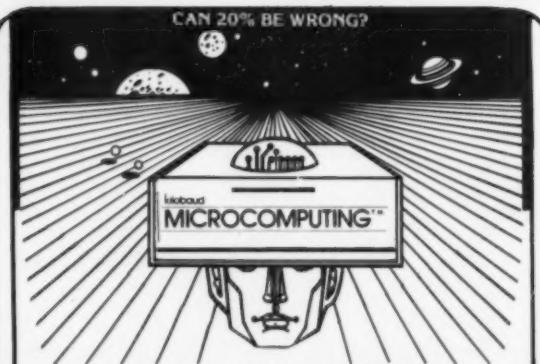
ORDER yours today and talk to the world.

SG7358 **$6.95**

The 1982 edition will be ready to ship in February.

*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop•Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. Add $1.50 handling charge for the first book; $1.00 for each additional book. Questions regarding your order? Please write to Customer Service at the above address. Please allow 4-6 weeks for delivery.

FOR TOLL FREE ORDERING CALL 1-800-258-5473



A recent survey showed that 20% of the 73 subscribers also read Kilobaud MICROCOMPUTING magazine . . . and enjoy it. This is the best way to learn and keep up with the rapidly developing world of microcomputers. There's nothing to be afraid of, you just have to read an interesting magazine and you'll learn. Try a subscription to Kilobaud MICROCOMPUTING and see for yourself.

☐ New subscription ☐ Renewal ☐ 12 issues for $25.00
☐ Payment enclosed $ _____ ☐ 24 issues for $38.00
☐ VISA ☐ MC ☐ AE ☐ Bill me ☐ 36 issues for $53.00

Card # _____ Interbank # _____
Signature _____ Exp. date _____
Name _____
Address _____
City _____ State _____ Zip _____

—for even faster ordering service call toll free (800) 258-5473

Canadian: $27, one year only, U.S. funds. Other foreign: $35, one year only, U.S. funds. Please allow 6-8 weeks for delivery. 322B6

MICROCOMPUTING • POB 997 • Farmingdale NY 11737

TRS 80* OWNERS ARISE!

Arise and subscribe to 80 MICROCOMPUTING, the newest and fastest growing microcomputer magazine. This is full of news about programs, accessories and theory on the world's largest selling computer, the TRS-80*—definitely beginner level and includes lots of program listings. Find out what all the fuss is about.

☐ New subscription ☐ Renewal ☐ 12 issues for $25.00
☐ Payment enclosed $ _____ ☐ 24 issues for $38.00
☐ VISA ☐ MC ☐ AE ☐ Bill me ☐ 36 issues for $53.00

Card # _____
Interbank # _____ Exp. date _____
Signature _____
Name _____
Address _____
City _____ State _____ Zip _____

80 microcomputing™

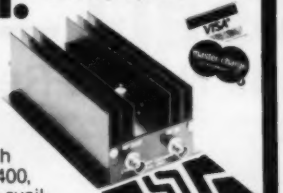
Please allow 6 weeks for delivery
Canadian: 1 yr. only/$27 in U.S. Funds
Foreign: 1 yr. only/$35 in U.S. Funds

• P.O.B. 981 • Farmingdale N.Y. 11737

*TRS-80 is a trademark of Tandy Corporation. 322B6

Take your favorite H.T. out for a drive tonight.

VISA or MASTERCARD for same day shipment.



For $64.95 you get the most efficient, dependable, fully guaranteed 35W 2 meter amp kit for your handy talkie money can buy.

Now you can save your batteries by operating your H.T. on low power and still get out like a mobile rig. The model 335A produces 35 watts out with an input of 3 watts, and 15 watts out with only 1 watt in. Compatible with IC-2AT, TR-2400, Yaesu, Wilson & Tempo! Other 2 meter models are available with outputs of 25W and 75W, in addition to a 100W amplifier kit for 430MHZ. ✓382

Communication Concepts Inc. 2648 N. Aragon Ave., Dayton, OH 45420 (513) 296-1411

IRON POWDER and FERRITE PRODUCTS

AMIDON Associates ✓334

Fast, Reliable Service Since 1963

Small Orders Welcome **Free 'Tech-Data' Flyer**

Toroidal Cores, Shielding Beads, Shielded Coil Forms
Ferrite Rods, Pot Cores, Baluns, Etc.

12033 OTSEGO STREET, NORTH HOLLYWOOD, CALIFORNIA 91607

ISO-440

FOR UNDISPUTED PERFORMANCE, EASY ASSEMBLY, VERY BROADBAND, LOW SWR, RUGGED MECHANICAL DESIGN . . . TRY THE AEA ISOPOLE™ ANTENNA FOR YOUR NEXT VHF OR UHF BASE STATION INSTALLATION

ISO-144
ISO-220

MAST NOT INCLUDED

FOR AEA ANTENNAS OR OTHER AEA PRODUCTS, CALL OR VISIT:

AEA

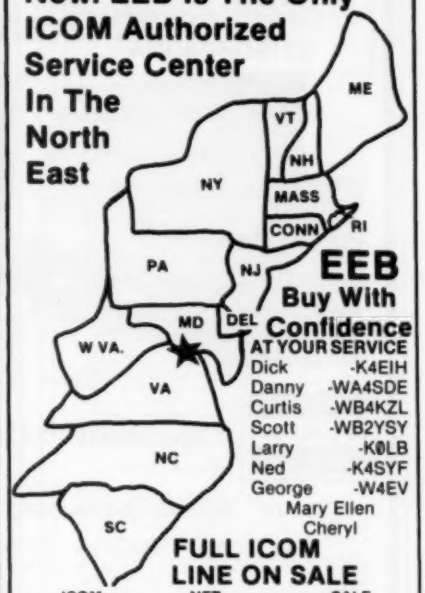
Brings you the Breakthrough!

BRITT'S 2-WAY RADIO
SALES & SERVICE
2508 Atlanta St. Smyrna, GA 30080
CALL: (404) 432-8006

ICOM

WINTER SALE

Now! EEB Is The Only ICOM Authorized Service Center In The North East



EEB Buy With Confidence

AT YOUR SERVICE

Dick	-K4EIH
Danny	-WA4SDE
Curtis	-WB4KZL
Scott	-WB2YSY
Larry	-KØLB
Ned	-K4SYF
George	-W4EV
Mary Ellen	
Cheryl	

FULL ICOM LINE ON SALE

ICOM	NET	SALE
IC 2AT	$ 269.50	$242.55
IC 3AT/4AT	$ 299.50	$269.55
IC 25A	$ 349	$314.00
IC 730DC	$ 829	$729.00
$40.00 factory rebate exp. Feb 27th Your cost will be $689.00		
IC 720ADC	$1349	$1199.00
IC 251A	$ 749	$669.00
IC 290A	$ 549	$489.00
IC 451A	$ 899	$779.00

FULL YAESU LINE ON SALE

FT 208R	$ 359.95	$323.00
FT 708R	$ 359.95	$323.00
FT 707	$ 810	$729.00
FT 101MKIII	$ 925	$799.00
FT 290R	$ 399	$359.00
FR 7700	$ 549	$479.00
FT 902DM	$1535	$1379.00
FT-ONE	$2995	$2,695.00

Becoming your #1 Amateur Store. Visit us on your next trip to Washington, D.C.

order desk
(800) 336-8473
prices subject to change
Tue-Sat
10am-4pm EST

Technical information, VA orders (703) 938-3350
Store opens 10am Tues-Sat
Close 5pm Tues, Wed, Fri,
Close 9pm Thurs, 4pm Sat

EEB
516 Mill Street, N.W.
Vienna, Virginia 22180
ELECTRONIC EQUIPMENT BANK

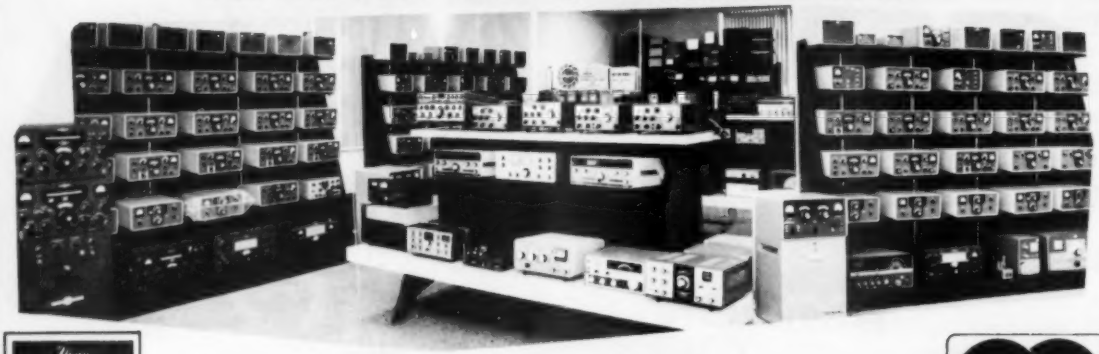
✓See List of Advertisers on page 114

ASSOCIATED RADIO **913-381-5900**

8012 CONSER BOX 4327
OVERLAND PARK, KANSAS 66204

BUY—SELL—TRADE

All Brands New & Reconditioned



Your BANKAMERICARD welcome here

We Want to DEAL—Call Us—We'll Do It Your Way.

WE'RE #1

master charge THE INTERBANK CARD

NOTE: SEND $1.00 FOR OUR CURRENT CATALOG OF NEW AND RECONDITIONED EQUIPMENT.

★ ALSO WE PERIODICALLY PUBLISH A LIST OF UNSERVICED EQUIPMENT AT GREAT SAVINGS.
A BONANZA FOR THE EXPERIENCED OPERATOR.

TO OBTAIN THE NEXT UNSERVICED BARGAIN LIST SEND A SELF ADDRESSED STAMPED ENVELOPE.

"ELEGANT"

DESIGNED FOR THE PARTICULAR HAM.

CLUTTERFREE CONSOLES

PRICES START AT $203.35

SEND FOR FREE BROCHURE 89

CLUTTERFREE MODULAR CONSOLES P.O. BOX 5103 TACOMA, WA. 98405 (206) 756 1811

THE AUTEK "QRM ELIMINATOR"

Model QF-1A For SSB & CW $73.00

115 VAC supply built-in. Filter by-passed when off. **Auxiliary Notch rejects 80 to 11,000 Hz! Covers signals other notches can't touch.** **Four main filter modes for any QRM situation.** **Continuously variable main selectivity (to an incredible 20 Hz!)** **Continuously variable main frequency. (250 to 2500 Hz)**

AUTEK pioneered the ACTIVE AUDIO FILTER back in 1972. Today, we're still the engineering leader. Our new QF-1A is the latest example. It's INFINITELY VARIABLE. You vary selectivity 100:1 and frequency over the entire usable audio range. This lets you reject whistles with dual notches (to 70 dB), or reject SSB hiss and splatter with a fully adjustable lowpass plus aux. notch. Imagine what the NARROWEST CW FILTER MADE will due to QRM! HP rejects low frequencies. Skirts exceed 80 dB. 1 watt speaker amp. Built-in 115 VAC supply. 6½x5x2½. Two-tone grey styling.

Even latest rigs include only a fraction of the QF-1A selectivity. Yet it hooks up in minutes to ANY rig--Yaesu, Kenwood, Drake, Swan, Atlas, Tempo, Heath, Collins, Ten-Tec, etc. Just plug it into your phone jack and connect spkr. or phones to the output. Join the thousands of owners who now hear stations they couldn't copy without a QF-1A! It really works!

WORLDS RECORD KEYER. OVER 4000 DX QSO'S IN 2 DAYS!

Model MK-1 Keyer $104.50

Probably the most popular "professional" contest keyer in use, yet most owners are casual CW operators or novices. After a few minutes, you'll see how memory revolutionizes your CW operation! Just start sending and record your CQ, name, QTH, etc. in seconds. 1024 bits stores about 100 characters (letters, numbers). Playback at any speed. Dot/dash memories, triggered clock, repeat, combine, 5 to 50 + WPM, built-in monitor and 115 VAC supply. Works with any paddle. Sit back and relax while your MK-1 calls CQ and handles standard exchanges!

Optional memory expander (ME-1) expands any MK-1 to 400 characters. ME-1 factory installed $35. Owner installed, only $25. Add more memory now or later!

Autek Research

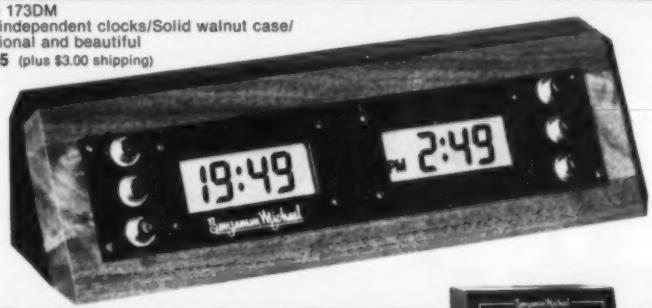
BOX 3025

ODESSA, FLORIDA 33556 • (813) 920-4349

NO LONG DELAYS. WE SHIP 95% OF ORDERS FROM STOCK

We sell only factory direct. No dealer markup in our price. Order with check, M.O., VISA, MC. We pay shipping in 48 states. Add 4% tax in Fla. Add $3 to Canada, Hi., Ak. Add $18 each elsewhere. (Shipped air.)

Model 173DM
Dual, independent clocks/Solid walnut case/
Functional and beautiful
$69.95 (plus $3.00 shipping)



Model 173B
Internal backlight/Aluminum
and Poly case/Portable
$34.95 (plus $3.00 shipping)

Independent Military Option

Military time format clocks by **Benjamin Michael**. Independent of power lines these units are energy efficient, secure, and free to provide accurate quartz controlled time in any setting. Used by the Military and U.S. government agencies as well as many municipal law enforcement and public safety departments, these units won't quit just because commercial power did.

Exercise your independent military option now.

420

Benjamin Michael Industries INC.

65 E. Palatine Road
Prospect Heights, IL 60070
312-459-5760

VISA MasterCard

EAST COAST #1 GOES NATIONAL

THE ANTENNA BANK is East Coast's #1 supplier of ANTENNAS — TOWERS ACCESSORIES

CUSHCRAFT:

A3 New Element Triband Beam	$165.00
A4 New 4 Element Triband Beam	$204.00
AV3 New 3 Band Vertical 10-20m	$ 40.00
AV4 New 4 Band Vertical 10-40m	$ 81.00
AV5 New 5 Band Vertical 10-80m	$ 87.00
RS 20-15-10m Motor Tuned Vertical	$202.00
32-19 19 Element 2m Boomer DX Beam	$ 74.00
214B 14 Element 2m Jr. Boomer 144-146	$ 60.00
A147-11 11 Element 2m	$ 33.00
ARX2B 2m "Ringo Ranger" II	$ 33.00

—COMPLETE LINE ON SALE—

MINI QUAD HQ-1 6-10-15-20m	$129.00

HY-GAIN:

V2 New 2m Vertical	$ 33.50
TH3JR 3 Element Triband Beam	$133.00
TH3MK3 3 Element Triband Beam	$175.00
TH5DX New 5 Element Triband Beam	195.00
TH6DXX 6 Element Triband Beam	$235.00
105BA 5 Element 10m "Long John"	$ 95.00
155BA 5 Element 15m "Long John"	$145.00
205BA 5 Element 20m "Long John"	$235.00
14AVQ 4 Band Vertical 10-40m	$ 48.00
18AVT 5 Band 10-80m Trap Vertical	$ 78.00

—COMPLETE LINE ANTENNAS ONLY ON SALE—

ROTORS & CABLES:

CDE HAM IV/CD4511	$165.00/94.00
Alliance HD73/U100	$92.00/42.00
RG8/U Foam 95% Shield	24¢/ft
RG213 Mil. Spec	28¢/ft
Mini-8	12¢/ft
8 Wire Rotor Cable	16¢/ft

Philly Stran Guy Cable in stock—for price & delivery information call (703) 569-1200

#1 ROHN TOWER DISTRIBUTOR SALE:

20G 10' Tower Section	$ 29.50
25G 10' Tower Section	$ 39.50
45G 10' Tower Section	$ 87.50
HDBX 48' Free Standing Tower	$320.00
FR2548 48' 25G Fold-over Tower	$695.00

(Freight prepaid on Fold-over Towers. Prices 10% higher west of Rocky Mountains)

We Stock Rohn Accessories—for price & delivery information call (703) 569-1200

HUSTLER SPECIAL COMPLETE LINE:

4BTV/5BTV 4 or 5 Band Vertical	$74.00/92.00
MO-1/MO-2 HF Mobile Mast	$ 17.50

HF MOB. RES.	STD. 4kw	SUPER 2.0kw
10 or 15m	$ 8.00	— $14.00
20m	$11.00	— $15.00
40m	$13.00	— $18.00
75m	$14.00	— $28.00

SF2 2m 5/8 Whip	$ 9.00
HOT "Hustleoff" Mount	$ 14.00
BM-1 Bumper Mount with Ball	$ 13.00

AVANTI AP151.3G Glass Mount	$ 27.95

W2AU Balun	$17.55 List/Sale	$ 13.35
Traps 10, 15, 20 or 40m	$24.95 List/Sale	$ 18.79

VAN GORDON:

PD 8010 10-80m Wire Dipole	$ 28.80
PD 4010 10-40m Wire Dipole	$ 25.20
PD 8040 40-80m Wire Dipole	$ 26.40
SD 40 40m Short Dipole	$ 21.60
SD 80 80m Short Dipole	$ 22.80
HiQ Balun	$10.95 List/Sale	$ 7.95
HiQ Center	$ 5.95 List/Sale	$ 4.95

ORDERS ONLY
(800) 336-8473

ALL OTHER CALLS (703) 569-1200
Shipping cost not included—Prices subject to change
ALLOW 2 WEEKS FOR DELIVERY
No COD—We ship UPS
We reserve the right to limit quantities

VISA

THE ANTENNA BANK
6460 General Green Way
Alexandria, VA 22312

MasterCard

See List of Advertisers on page 114

FACTORY-DIRECT INFLATION FIGHTERS! PRICES SLASHED DRAMATICALLY!

MULTIMETER WITH SWR/ POWER METER MODEL MM-1 ..... $35.

The MM-1 is high quality 20K-ohm/VDC Multimeter usable as the SWR/Power Meter as well by connecting the directional coupler unit included.

Specifications:

DC Volt	0 — 0.3, 1.2, 6, 30, 120, 600V (20K-ohm/V) ± 3%
AC Volt	0 — 6, 30, 120, 600V (8K-ohm/V) ± 4%
DC mA	0 — 60uA, 3, 300mA ± 3%
OHM	Rx1, Rx10, Rx1K
dB	−20 —+18 0 — +32dBm
C	200pF — 0.5uF
LI	0 — 0.1, 10, 100mA
Frequency Coverage	3.5 — 150MHz
VSWR	1:1 — 3:1
RF Power Range	0 — 20, 200, 1000W ± 10%
Accessory Included	Directional coupler unit with relevant connector cable, test leads and battery
Dimensions	4⅛"(W) x 6¼"(H) x 2"(D) Multimeter 4¼"(W) x 2¼"(H) x 2"(D) Coupler
Net Weight	1.06 lbs. (480 grams) Multimeter 0.75 lbs. (340 grams) Coupler

SWR & POWER METER FOR HF/VHF BAND MODEL PM-3HV ..... $40.

High quality SWR/Watt meter designed as SWR and power can be measured independently at a time. With meter illumination and "On-the-Air" indicator lamp.

Specifications:

Frequency Coverage	3 — 150MHz
RF Power Range	0 — 20, 200, 1,000W, 3 ranges ± 10% accuracy
Power Source	12V AC/DC (for meter illumination only)
Accessory Included	7ft. long connector cable with fuse for meter illumination purpose
Dimensions	7"(W) x 3"(H) x 3½"(D)
Net Weight	1.8 lbs. (0.8 kgs)

SWR & POWER METER FOR HF/VHF BAND MODEL PM-4HV ..... $30.

Compact and light weight SWR/Watt meter designed for mobile operation as well as base station use.

Specifications:

Frequency Coverage	3 — 150MHz
RF Power Range	0 — 20, 200, 1,000W, 3 ranges ± 10% accuracy
Accessory Included	Velcro double back adhesive mounting for mobile installation
Dimensions	6"(W) x 2¾"(H) x 2½"(D)
Net Weight	1 lb. (0.44 kgs)

Mfg. by: AIKIGAWA ELECTRONICS CORP. • Exclusive Distributors: McCAW ELECTRONICS, INC. • P.O. Box 66; Carlsbad, CA 92008; Phone: (714) 434-1078; TELEX: 181743 MACAW CSBD

58

Prices do not include shipping and handling and are subject to change without notice

MIDCOM

CALL NUMBER ONE!

CARLOAD INVENTORIES • ROCK BOTTOM PRICES
SUPER-FAST SERVICE

LINES								
	AEA	ALPHA	CUSHCRAFT	DENTRON	KANTRONICS	MINI-PRODUCTS	NYE	TEN TEC
	AVANTI	BEARCAT	COLLINS	HY GAIN	KLM	MOR GAIN	PALOMAR ENG	UNIVERSAL
	ASTRON	BIRD	CDE	HUSTLER	KENWOOD	MIRAGE	REGENCY	UNARCO-ROHN
	ALLIANCE	BENCHER	DRAKE	ICOM	MICROLOG	MFJ	SWAN	VIBROPLEX

CALL TOLL FREE 1-800-325-3609 IN MISSOURI 314-961-9990

MID-COM ELECTRONICS • 8516 MANCHESTER ROAD • BRENTWOOD, MO 63144

52

NOVAX

Introducing

MOBILE CONNECTION

↵ 21

YOUR OWN AUTOPATCH FOR SIMPLEX OPERATION

ONLY $149.95 KIT

Wired and Fully Tested $199.95 • Shipping $3.50 in U.S.A. • N.Y.S. Residents add appropriate sales tax

Hundreds already in operation • Call anyone—anywhere—anytime

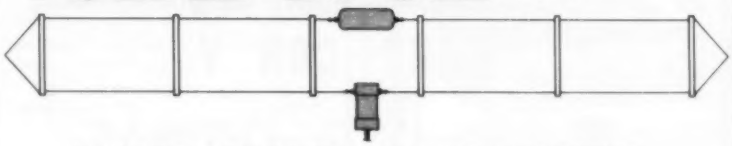
NOVAX interfaces your standard 2 meter; 220; 450; etc. base station and DTMF (Touchtone) Telephone, using a high speed scan switching technique so that you can direct dial from your automobile or with the HT from the backyard or poolside—automatically. Easy installation. Ringback (reverse autopatch) option available for $29.95 kit—$39.95 factory wired.

- SMALL SIZE—(5" x 6" x 2")
- STATE OF THE ART CIRCUITRY 12–16 V.D.C.
- ADJUSTABLE ACTIVITY TIMER (clears out if mobile is out of range)
- EASY INTERFACING with radio audio & squelch circuit
- SINGLE DIGIT CONTROL (connect and disconnect)
- 3 MIN. CALL DURATION TIMER

TO ORDER—SEND Check—Money Order (MasterCard or Visa accepted) to: R.W.D. Inc., Oriskany, N.Y. 13424 or call 315-736-3087

BROAD BAND FOLDED DIPOLE

BARKER & WILLIAMSON'S MODEL 370-15



B & W's Broad Band Folded Dipole covers all amateur bands including the new 12, 17, and 30 meter bands. Also covers CAP frequencies, MARS, Military or any frequency from 3.5–30 MHz. Being used throughout the world! Total length only 90 feet long—spreader spacing 19 inches. SWR—less than 2:1 from 3.5–30 MHz. Rugged construction for long life. Can be installed as a flat top—inverted "V" or sloper. Also available for 2–22 MHz. Power handling capability 2 KW–4 KW PEP. Supplied completely assembled with RG 8 type cable with SO-239 connector. Terminated with PL-259 connector on each end. Patent Pending.

Price $149.50

Cable available in the following sizes:

25 ft.	$18.25
50 ft.	$26.00
75 ft.	$33.75
100 ft.	$41.50

↵ 11

B&W

Barker & Williamson, Inc.
10 Canal Street
Bristol, Pa. 19007
Phone #215-788-5581

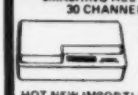
VISA MasterCard

ETCO

CABLE TV CONVERTERS AND OTHER GOOD STUFF!

↵ 91

SMASHING ALL SALES RECORDS – OUR NEW 30 CHANNEL CABLE TV CONVERTER!



Converts mid & super band cable channels for viewing on your TV set! No. 354AE047

39.95 $34.95 ea. / 5

HOT NEW IMPORT! REMOTE CONTROL 30 CHANNEL CABLE TV CONVERTER!

89.95 $79.95 ea. / 5 $74.95 ea. / 10

Includes remote TV on/off switch and fine tuning control! No. 354VA275

ETCO MKII WIRELESS – THE ULTIMATE CABLE TV CONVERTER!

Set TV to channel 3, and the hand-held remote control does it all! No. 354ZA008

189.00

VIDCOR 2000 CONVERTER ELIMINATES PROBLEMS WHEN VIDEOTAPING FROM CABLE TV

89.95

Restores your VCR's cable ability for re-programming. Re-stores remote channel con-trol. Enables videotaping of one cable program while watching another. No. 354VA950

UNUSUAL FACTORY SURPLUS MID-BAND – SUPER-BAND CABLE TV TUNER

Converts cable channels to a common I.F. frequency. Eliminates fault cable convertors, decoders, etc. With schematic. No. 354VA342

19.95 $17.50 ea. / 10

354VA389 Detailed schematic & spec sheet $1.50

FACTORY SURPLUS UHF TUNERS

4.95 $3.95 ea./10

Brand new production surplus. All solid state. Ideal for experimental work building cable TV converters, etc. No. 354SU099

MINIATURE FM WIRELESS MICROPHONE

Hides in the palm of your hand. Reception on any standard FM radio or receiver No. 354VA882

29.95 $27.50 ea. / 5 $24.95 ea. / 10

QUARTER-MILE WIRELESS MICROPHONE & RECEIVER SYSTEM

69.95 $60.95 ea. / 5

FCC approved crystal controlled wireless mike & receiver. All battery operated. Electret with range reverse. VU meter. No. 354VA093

FACTORY SURPLUS VHF / UHF "TWIN" VARACTOR TUNERS!

Admiral No. NC 3143.1 BRAND NEW! Ideal for inserting or repairing most virtually tuned TV FRONTENDS. A hard to find item at a sensational price! No. 354VC360

39.95 $34.95 ea. / 5

DUMPING! NORELCO ENDLESS LOOP CASSETTES!

4.95 $4.49 ea./10

Impossible to find at any price!
2 minutes – No. 354VA600
6 minutes – No. 354VA606

IN STOCK – THE MURA CORDLESS TELEPHONE SYSTEM!

Answer & intercom calls with this easy-to-use speakerphone. 400 ft. range. Hi-Tech "Autopulse" Lets number recall. Pag-ing feature. Use with rotary, touch tone or pulse. No. 354VA274

144.88 $129.95 ea. / 5

SALE OF QUARTZ BATTERY-OPERATED CLOCK MOVEMENTS!

9.95 $8.95 ea. / 5

Accuracy of 1 min. per mo. to 6 years operation on 1 alka-line "C" cell. Imported from West Germany. No. 354VA551

354VA385 Matching hands $2.49/set $1.95/set / 5

20 AMP REGULATED 12VDC POWER SUPPLY!

13.8 volts no load, 12.5 volts full load. Easily handles high dynamic ratio SSB transceivers to 400w P.E.P. Brand new, factory tested. 110 VAC. No. 354VA394

69.88 $55.95 ea. / 5

354VA395 as above, 10 amps $84.95 $49.95 ea. / 5

FREE OUR LATEST 98 PAGE FASCINATING CATALOG

ETCO ELECTRONICS
NORTH COUNTRY SHOPPING CENTER
PLATTSBURGH, N.Y. 12901

Check with order, please. Visa & Mastercard OK. Sorry, no C.O.D.'s. Add 10% for UPS & Handling (Excess refunded). N.Y. State residents add 7% sales tax. Dealer & Export inquiries invited. Our telephone order desk never closes. Call 1 518 561 8700

Copy RTTY, ASCII and Morse from the palm of your hand.

Have you waited to get into code reading until you found out what this latest fad was about? You can stop waiting, because it's no longer a fad.

Amateurs everywhere are tossing the gigantic clanking monsters of yesteryear that once performed the job of reading radioteletype. They are trading them in for state-of-the-art code-reading devices that are incredibly small, noiseless if desired and infinitely more versatile than their antique predecessors.

Kantronics, the leader in code-reading development, has just introduced the latest and most-advanced breakthrough in the copying of Morse code, radioteletype and ASCII computer language.

The **Kantronics Mini-Reader** reads all three types of code, displays code speed, keeps a 24-hour clock, acts as a radioteletype demodulator and reads all of its decoded information out on a traveling display of 10 easy-to-read characters. It is so compact that it fits in a hand-held, calculator-size enclosure.

At **$289.95**, the **Mini-Reader** outperforms anything within another $400 of its price range.

Call or visit your Authorized Kantronics Dealer now to find out what the latest in technology has done to code-reading.

Kantronics
(913) 842-7745
1202 E. 23rd Street
Lawrence, Kansas 66044

IMPROVE YOUR MORSE SKILLS

WITH THE

AEA

MODEL KT-1
KEYER TRAINER

FEATURES INCLUDE:

- PRECISE SPEED CONTROL
- 24,000 CHARACTER PSEUDO-RANDOM LOOP WITH 10 STARTING POINTS AND FREE ANSWER BOOK
- EXCLUSIVE AUTOMATIC SPEED INCREASE
- RANDOM PRACTICE MODE
- OPERATES FROM 12 VDC

call or visit:

AEA
Brings you the Breakthrough!

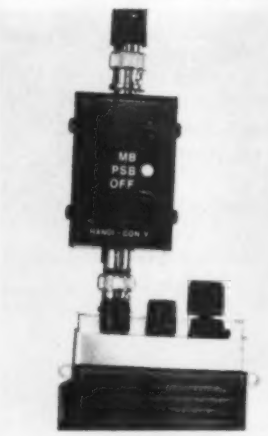
DERRICK ELECTRONICS
714 West Kenosha
Broken Arrow, OK 74012
TOLL FRFEE (800) 331-3688

H. T. USERS

☒ IT'S PORTABLE — PLUS.
☒ IT'S WIDELY COMPATABLE
☒ IT'S SELF CONTAINED
☒ IT'S EASY TO OPERATE

IT'S
M^2 ENGINEERINGS' NEW

HANDI-CON V



RADIO NOT INCL.

- ANY FULLY SYNTHESIZED 2-METER H.T. CAN NOW BE A COMPLETELY PORTABLE VHF-hi MONITOR
- 2400 CHANNEL CAPABILITY
- DOUBLE BAND COVERAGE.
  154-158 Mhz fire, police, sheriff, paging & more
  159-163 Mhz maritime coastal, railroads, N.O.A. weather & more.
- MULTI-BAND & MULTI-CHANNELLED MONITORING WITH SCANNING H.T.'s
- SINGLE 3-POSITION CONTROL
- "OFF" RETURNS TO NORMAL TRANSCEIVER OPERATION
- LOW LOSS COUPLING TO ANTENNA
- UP TO 6 MOS. OPERATION UNDER AVG. USE WITH A SINGLE AAA CELL
- BI-LATERAL PROTECTION AGAINST ACCIDENTAL TRANSMISSION FOR UP TO 5 WATTS
- size - 2.25 x 1.5 x 1.4 inches
- weight - 4.5 ozs.

$44.95 +$2.50 pstg. & hndlg.
in Calif. add 6% s.tx.

contact: M SQUARED ENG.
1446 Lansing ave.
San Jose, Cal. 95118
-or-
Ph. 408-266-9214

Please write for club discounts
on quantity orders

77

hey look here

call toll free:nights

1-800-231-3057

6-10 PM CT, M.W.F.

days 1-713-658-0268

ICOM	IC 3AT/IC 4AT	269.00 ea
	IC 25A	309.00
	IC 730	729.00
	IC 2AT	249.00
	IC 22U	269.00
Santec	HT 1200	269.00
	ST 144UP	299.00
Telrex	10% Off List on Stock Items	
Drake	TR5	995.00
	R7/DR7	1299.00
AEA	Morsematic	169.00
	CK1 Contest	115.00
	MBA-RO Reader	269.00

Order **KWM380** $3095.00
& 2 Free Filters
High Serial Numbers, All Mods

Amphenol Silverplate PL259 ..... 1.00 ea.
Antique /rare Tubes ..... Call
Timex 24 Hour Wallclock 24.95
Robot 800A 749.00
400 ..... 675.00
Hal Ct2100 ..... 699.00
KB2100 ..... 159.00
New CWR 685A Telereader . 875.00
Cubic 103 ..... 1195.00
Bird 43, Slugs ..... Stock
Drake Theta 7000 ..... 995.00
Belden 9405 Heavy Duty Rotor Cable 2#16, 6#18 ..... 45¢/ft.
Belden 8214 RG-8 Foam ... 36¢/ft.
Belden 9258 RG8x Mini-Coax 19¢/ft.
Belden 8267 RG 213 Non Contam Jacket ... 43¢/ft.
Alliance HD73 ..... 109.95

Large Bookstore
10% Off **Curtis, Sherwood, Palomar**
Call Quotes **Kenwood TS830S, TS530S, TS130S**, New
We Want Special Orders!
Yaesu Specials
New FT1 ..... 2395.00
FT 707 ..... 649.00
FT 101ZD/Mark 3 .. 749.00
FT 208R 289.00

MASTERCARD VISA

All prices fob Houston except where indicated. Prices subject to change without notice, all items guaranteed. Some items subject prior sale. Texas residents add 6% tax. Please add sufficient postage, balance collect.

MADISON
Electronics Supply
✓45 1508 McKinney
Houston, Texas 77010

Lacue Likes You . . . and you'll like Lacue

WIRE AND CABLE

RG-213	27¢/ft
RG-8/U foam, 95% shield	23.5¢/ft
RG-8X foam, 95% shield	11¢/ft
RG-58C/U mil spec	11¢/ft
RG-59 mil spec	9¢/ft
RG-11	19¢/ft
450 ohm ladder line 100 ft roll	$10.25
8 Conductor Rotor Cable	15¢/ft
14 Ga. Stranded Copper (50 ft. multiples)	7¢/ft
12 Ga. Solid Copperweld (50 ft. multiples)	7¢/ft
14 Ga. Solid Copperweld (50 ft. multiples)	5¢/ft
8 Ga. Solid Aluminum (50 ft. multiples)	6¢/ft

ANTENNA ACCESSORIES

Ceramic Insulators	45¢ ea
Amphenol PL-259	75¢ ea
Van Gorden Balun	$7.50
Center Insul	$4.60
W2AU Balun 4:1 or 1:1	$13.25
B&W Traps 40 thru 10	$25.65 per pair
B&W Traps 80 thru 10	$25.65 per pair

ROTORS

CDE TAILTWISTER	$228.00
CDE HAM 4	$162.95
CDE CD 45	$ 89.55
CDE AR 22	$ 48.95

1982 CALLBOOKS

U.S. version	$14.95
DX version	$14.05

ALSO AVAILABLE
Cushcraft, Hy-Gain, Telex, Bencher, Butternut, Regency, Mini Products, Larson, B&W, Hustler, Shure, ARRL, Bird, Callbook, Ameco, Sams Publications, Rohn, Vibroplex, Ham Key, Vocom, Daiwa, and many more.
Prices subject to change without notice.
Hours: Mon.—Sat. 10AM—6PM; Tues. & Fri. 'til 9PM
Telephone: (814) 536-5500

LACUE COMMUNICATIONS ELECTRONICS
102 Village Street
Johnstown, PA 15902
✓4

SMP 2300 MHz

Now Order Toll Free!
1-800-368-3028

TU-8—44.95. Deluxe Tunable PS. Very smooth tuning MIL SPEC pot. 8-12V. Complete.

UCC-1—35.00. Downconverter Kit. 2100-2500 MHz. Quality board and components.

SMC-2—50.00. Deluxe downconverter kit. With high gain RF transistor and temperature compensation.

RFA-1—44.95. 2 stage RF preamp. Selective filter; 16 db net gain.

Large SASE brings catalog of kits and parts and the 2300 MHz story.

All prices postpaid in U.S.
VISA and MC accepted.
In Virginia, Alaska and Hawaii
Call 703-255-2918.

✓376

SMP
Superior Microwave Products, Inc.
P.O. Box 1241
Vienna, Virginia 22180

INTRODUCING THE

CES 500SA SIMPLEX AUTOPATCH

The First Affordable Private Phone Patch

As described in 73 Magazine, 6/81.

Now, for the first time! Every amateur operator can enjoy the unparalleled freedom of a private phone patch in an economical package.

The dramatic new CES 500SA Autopatch is all the equipment you need to patch an FM base station to your home or other telephone line, without expensive repeaters, cavities, or other equipment. Connections with any standard FM base station are rapid and simple.

Bypass the congestion and expense of shared repeaters — break through to greater privacy and convenience with the new CES 500SA Autopatch.

COHERENCE IN COMMUNICATIONS TECHNOLOGY

CES

COMMUNICATIONS ELECTRONICS SPECIALTIES, Inc.

P.O. Box 507
Winter Park, Florida 32790
Telephone: (305) 645-0474

✓See List of Advertisers on page 114

✓462

2300 MHz MICROWAVE DOWNCONVERTERS

DOWNCONVERTER
Kit $28.50
Assembled. $48.50

2300 MHz PREAMP
Kit $25.00

POWER SUPPLY
Assembled. $35.00

SATELLITE TV EARTH STATION
- 24 Channel Receiver
- 10′ Antenna
- Dexcel 120° LNA

Call for details and price

Also Available: Commercial System with Bogner Antenna $169.00

2300 MHz ANTENNA

WITH BOX FOR DOWN-CONVERTER
$27.50

PB RADIO SERVICE
✓404
1950 E. PARK ROW • ARLINGTON, TX 76010

CALL ORDER DEPT. TOLL FREE
(800) 433-5169

FOR INFORMATION CALL
(817) 460-7071

BASSETT HELIUM MOBILE ANTENNAS

For Commercial, Amateur, and Government Services

Rugged, low drag, high efficiency mobile antennas engineered to maintain resonance at all times.

Maximum overall height of only 70". Average weight of only 6 oz. They remain vertical at all speeds.

Helical inductors sealed in helium filled Fiberglass impervious to all weather. Adjustable 17-7ph whips and solid brass hardware chrome plated and polished.

Optimum gain collinears for VHF and UHF. Unity gain models for HF. Amateur band models are inventoried for "off the shelf" delivery. Commercials to specs.

Write or phone for free brochure and prices on Bassett mobiles and Helium Trap Antenna Systems.

REX BASSETT ELECTRONICS, INC.
1633 NE 14th Ave., Bldg. 11
Ft. Lauderdale, Fla. 33305
Tel: 305/561-1400
✓440

RTTY/CW For the TRS-80*

* A Trademark of the Tandy Corp.

ROM-116
RTTY/CW Operating System
Detailed brochure available on request.

Featuring:

1200 BAUD OPERATION. Not limited to 110 baud because of timing loops. 60, 66, 75 & 100 W.P.M. Plus 110, 150, 300, 600 & 1200 baud operations possible.

FLEXABILITY OF OPERATION. Instantly change: Baud Rates; Program Mode (ASCII/baudot); Program Status

SPLIT SCREEN VIDEO. Transmit & receive data displayed separately.

REAL TIME. Automatic CW/ID without user intervention. Automatically updates at end of month or year.

Other features include:
- Two Serial Ports
- Fourteen Buffers
- Automatic CW ID
- Transmit Control
- Selective Call Feature
- Error Correction
- Word Wrapping
- Easy To Interface
- 30 Day Unconditional Guarantee
- Hardware requirements: TRS-80 Model 1 or 3 16K External terminal unit

CROWN MicroProducts

606 State Street, P.O. Box 892-R • Marysville, WA 98270 • (206) 659-4279

The HAM SHACK

808 N. Main
Evansville, IN 47711

TEN-TEC	
546 Omni-C Xcvr	$1050
580 Delta	750
525 Argosy	480
280 Power Supply	150
255 Power Supply/Speaker	170
243 VFO-Omni	169
283 VFO-Delta	169
234 Speech Processor	125
SANTEC	
ST-144/μP	call
AEA MBA Reader	275
ALLIANCE HD73 Rotator	99
AZDEN PCS-300 2m Hand Heid	call
CUBIC Astro 103	1175
DAIWA CN518 2.5 KW Tuner	285
HAL CT 2100	call
HY-GAIN TH7 Tri-band Ant.	call
ICOM 25A 2m Mobile	309
ICOM 251A 2m All Mode	625
KANTRONICS miniReader Package	259
MFJ 496 Keyboard	290
MFJ 722 Notch/CW/SSB Filter	59
MIRAGE B3016 2m Amplifier	205

812-422-0231
✓449
MON-FRI 9AM-6PM • SAT 9AM-3PM
Write for our new and used equipment list

SYNTHESIZED SIGNAL GENERATOR

MADE IN USA

MODEL SG 100C $329.95 plus shipping

• Covers 100 to 179.999 MHz in 1 kHz steps with thumb-wheel dial • Accuracy .00001% at all frequencies • Internal frequency modulation from 0 to over 100 kHz at a 1 kHz rate • Spurs and noise at least 60dB below carrier • RF output adjustable from 5-500mV across 50 ohms • Operates on 12vdc @ ½ amp. In stock for immediate shipping. $329.95 plus shipping. Overnight delivery available at extra cost. • Range Extender (phase-locked mixer/divider) for above unit. Extends the range from .1 to 580 MHz. Same size as SG-100. Mounts piggyback. Price: $299.95.

311

VANGUARD LABS

198-23 Jamacia Ave., Hollis, NY 11423
Phone: (212) 468-2720

CB TO TEN METER CONVERSION KITS

KITS for AM—SSB—FM 40 Channel PLL chassis conversions
DETAILED INSTRUCTIONS for easy installation with minimum time and equipment
BAND COVERAGE flexibility provides up to 1 MHz coverage for most PLL chassis.
PRICES Low cost prices range from $8.00 to $50.00
All kits are in stock including several different FM kits.
FREE CATALOG Write or call today.

78 **INDEPENDENT CRYSTAL SUPPLY COMPANY**
P.O. Box 183
Sandwich, Ma. 02563-0183
(617) 888-4302

AMP LETTER

(AMP' LET TER) n. 1. An Amateur Radio publication devoted to the design, construction, and operation of Amateur Amplifiers. 2. A newsletter that can save you money on your next amplifier construction project. 3. A source of parts and information.

The AMP-LETTER is published and mailed First Class every three weeks (17 times/year). It is organized into five departments:

I Editor's Corner
II Letters
III Tech Topics & Tips
IV Feature Article
V AMP-LETTER TRADER

Have parts to sell? Run an ad in the AMP-LETTER TRADER. Subscriber rate is 10¢ per word.

The AMP-LETTER believes that homebrewing an amp can be fun, educational, and half as costly as buying a commercial amp.

A one year subscription to the AMP-LETTER is $18.00/year (17 issues). Mention "73" Magazine and you may subscribe at the special one time rate of $15.00/year.

DON'T MISS A SINGLE ISSUE OF THE AMP-LETTER

AMP-LETTER
RR2 Box 39A
Thompsonville, IL 62890
97

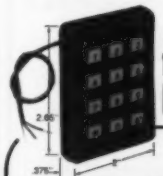
Place an ad, 10¢/word

Send $2.00 for a sample copy, or $15.00 for a full year of the AMP-LETTER.

C.B. TO 10 METER KITS
AMERICA'S #1 SOURCE FOR FM — SSB — AM

IN STOCK—Kits for most C.B. Models
NEW—10-meter FM Discriminator Board—fits most PLL rigs. Kit—Assembled and tested.
NEW AND USED—FM & SSB converted C.B.s now in stock—from $90.
LOW COST—Prices range from $10 to $50.
ORDER BY PHONE—(617) 771-4634
VISA & MASTERCARD—accepted
FREE CATALOG—write or call today!

AMERICAN CRYSTAL SUPPLY COMPANY
P.O. BOX 638
WEST YARMOUTH, MA. 02673
(617) 771-4634
7



THE PROFESSIONAL **TOUCH TONE ENCODER**

An ultra high quality encoder for professional application. Absolute reliability and function makes the difference. There's a Pipo encoder for every system and application. Totally serviceable, easy to operate and install. *Call or write for free catalog and information!* (213) 852-1515 or P.O. Box 3435, Hollywood, CA 90028.

PATENTED • AT&T

Pipo Communications
Emphasis is on Quality & Reliability 300

PILOTS

The RST-442B voice actuated intercom ($59.50) is just one of over 20 exciting avionics kits from Radio Systems Technology. Test gear too!

FREE CATALOG

Call toll free outside California.

800 824-5978
OTHERWISE 916 272-2203

381

Radio Systems Technology, Inc.
10985-G GRASS VALLEY AVE.
GRASS VALLEY, CA 95945

QUALITY MICROWAVE SYSTEMS
2100 TO 2600 MHz ANTENNAS MINIMUM 34 db GAIN OR GREATER

Complete System as pictured (6 month warranty)	$149.95
Down Converter (Probe Mntd.) assembled & tested	$59.95
Down Converter (Chassis Mtnd.) assembled & tested	$59.95
Power Supply, assembled & tested	$49.95
Down Converter PC board, with parts, unassembled & Data	$39.95
Data Information (Plans)	$9.95

Send cash, check or money order to:

Phillips-Tech Electronics
Dept. SP-73 421
P.O. Box 33205
Phoenix, Arizona 85067

For special quantity pricing, C.O.D.'s, Mastercharge, and VISA call:
(602) 274-2885

FINALLY... A SQUARE DEAL ON YOUR ELECTRONIC SCRAP

Many "brokers" pay flat rates on scrap, not payment on the value of your material. All material sent to us is individually refined and assayed for maximum return. Take a look at some typical yields:

PC Boards . . . . . 50¢ to $7 per lb.
Connectors . . . . . 25¢ to $5 per lb.
PC Fingers . . . . . $3 to $20 per lb.
Gold plated pins . . . $12 to $50 per lb.

For further information, circle our reader service number or call/write:

er *ELECTRONIC RECYCLERS OF MASS., INC.*
263A S. Main Street, Box 6
Middleton, Mass. 01949
Toll Free (800) 343-8308
In Mass. (617) 777-0455

82

Copyright 1981 Electronic Recyclers of Mass. Inc.

WE'VE GONE NATIONAL

Strux Corporation manufactures and distributes National Radio, Inc. Components: Chokes, inductors, coils, and hardware. We also distribute fixed and roller inductors, contactors, mil-spec and designer knobs. For all your electronic needs, contact Strux Corporation, 100 East Montauk Highway, Lindenhurst, New York 11757.

STRUX 30
CORPORATION
100 EAST MONTAUK HIGHWAY
LINDENHURST, NEW YORK 11757

See List of Advertisers on page 114

It's Incredible!

CODE QUICK

Now You Can Master Code . . .

For your first ham license or upgrade in a matter of days. **CODE QUICK** is a revolutionary breakthrough discovery which drastically simplifies the learning of Morse Code. Don't torture yourself with an endless maze of dits and dahs. With **CODE QUICK** each letter magically calls out its own name! Your amazing kit contains 5 power-packed cassettes, visual breakthrough cards, and original manual. send **$39.95** today to:

WHEELER APPLIED RESEARCH LAB
P.O. Box 3261
City of Industry, CA 91744
Ask for **CODE QUICK #103**
(Calif. add 6½ sales tax.)

Even if you have failed before **CODE QUICK** must work for you or return the kit for total immediate refund!

DIRECTION FINDING?

New Technology (patent pending) converts any VHF FM receiver into a modern Doppler Radio Direction Finder. **No receiver mods required.** See June 1981 issue of **73** for technical description. Kits available from $245. Write for full details and prices.

DOPPLER SYSTEMS
5540 E. Charter Oak
Scottsdale, Arizona 85254
(602) 998-1151 ✓425

GO MOBILE WITH YOUR H.T.!

ICOM Available — Guaranteed!

NOW FOR FT-208R & TR-2500

A unique battery eliminator
HANDI-TEK Regulator allows constant hand-held operation from auto DC or base supply with no nicad drain and WITHOUT RADIO MODIFICATION!
Model I—Icom IC-2A/T; K—TR-2400; N—FT-208R
Y—FT-207R, T—Simple mod for Temp
$24.95 PPD in USA. CA add $1.50.
✓460

HANDI-TEK
P.O. BOX 2205, LA PUENTE, CA 91748
Icom—slides on bottom of radio
Yaesu—fits into battery compartment
Kenwood—powered thru battery plug

CERTIFIED INTERNATIONAL

YOU WILL BE GLAD YOU CHECKED WITH US FOR
CUSHCRAFT AND HUSTLER (full line at 20% off), LARSEN, UNADILLA, BELDEN, COPPERWELD, SIGNALCRAFTER, PALOMAR, NYE-VIKING, TRIONYX, TRAC, JANEL, BENCHER, VIBROPLEX, AMPHENOL, GOULD, WELLER, EVEREADY AND OTHERS

WE STOCK EVERY KIND OF WIRE THE AMATEUR NEEDS, BY BELDEN, others

CRYSTALS FRESH CUT TO YOUR ORDER FROM $4.00

QSL's CUSTOM MADE FOR YOU

CB TO 10 METER CONVERSIONS FROM THE STANDARD SETTER

CERTIFIED COMMUNICATIONS

✓321 WE CONVERT OVER 150 MODELS $45 AND UP, AND SELL NEW 10 METER RIGS WITH DOUBLE WARRANTY FROM $179.00

ASK FOR QUOTE, CATALOG, CONVERSION BOOKLET, QSL SAMPLES (INCLUDE $0 amt), OR INFORMATION.

WE BRING OUR STORE TO YOU AT OVER 70 HAMFESTS PER YEAR. SEE YOU IN SOUTH BEND, ARLINGTON HEIGHTS AND WEST ALLIS

IT'S WORTH YOUR WHILE TO CALL OR WRITE

CERTIFIED INTERNATIONAL

THE HMR II

MICROWAVE RECEIVER SYSTEM

24+ dB GAIN • TUNABLE 2.1 TO 2.6 GHz RANGE
6 MONTH WARRANTY • COMPLETE-READY TO INSTALL
PARTS OF HMR II AVAILABLE SEPARATELY

$139.95 EACH
FOB DENVER
7 lbs.

SEND CHECK, MONEY ORDER OR CERTIFIED FUNDS TO:
HMR
PO BOX 440668 • AURORA, COLORADO 80044
DEPT. MB

FOR THE LOWEST PRICE ON QUANTITY ORDERS, CODs, MC OR VISA ORDERS CALL:
✓9 **(303) 620-9736**

FOR THE DO-IT-YOURSELFER

DOWN CONVERTERS		POWER SUPPLY	
ASSEMBLED & TESTED PCB		ASSEMBLED & TESTED	
WITH PLANS	69	WITH PLANS	69
PCB, PARTS & PLANS	59	PCB, PARTS, CASE & PLANS	59
PCB & PLANS	19	PCB & PLANS	19

PLANS $5

S-LINE OWNERS

ENHANCE YOUR INVESTMENT

with

TUBESTERS™

Plug-in, solid state tube replacements

- **S-line performance—solid state!**
- **Heat dissipation reduced 60%**
- **Goodbye hard-to-find tubes**
- **Unlimited equipment life**

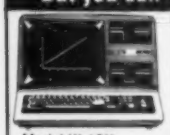
TUBESTERS cost less than two tubes, and are guaranteed for so long as you own your S-line.

✓433

SKYTEC
Box 535
Talmage, CA 95481

Write or phone for specs and prices.
(707) 462-6882

You can pay more — But you can't get more!



Model III 16K
$839
Model III 48K
2 disc & RS232C
$2100

Color Computer 4K
$310
w/16K Ext. Basic
$459

BUY DIRECT. These are just a few of our great offers which include Printers, Modems, Computers, Peripherals, Disc Drives, Software and more. call TOLL FREE **1-800-343-8124**

We have the lowest possible fully warranteed prices and a full complement of Radio Shack Software. ✓444

computer plus

Write for your free catalog.
245A Great Road
Littleton, MA 01460
617 • 486 • 3193

YAESU FT-207R OWNERS

AUTO SCAN MODULE AND BATTERY SAVER KIT

15 minutes to install; scan restarts when carrier drops off; busy switch controls automatic scan on-off; includes module and instructions.
Model AS-1. $25.00

WRITE FOR CLUB DISCOUNTS

new

FT-207R BATTERY SAVER KIT
MODEL BS-1 $14.95

- *No more dead batteries due to memory backup
- *30% less power drain when squelched
- *Simple to install; step-by-step instructions and parts included
- *4 mA memory backup reduced to 500 μA.
- *45 mA receiver drain reduced to 30 mA.
- *Improved audio fidelity and loudness

ENGINEERING CONSULTING
P. O. BOX 94355 ✓400
RICHMOND, B. C. V6Y2A8, CANADA

Subscription Problem?

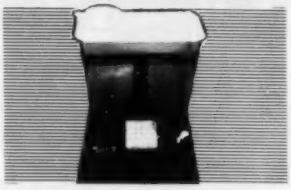
73 Magazine does not keep subscription records on the premises, therefore calling us only adds time and doesn't solve the problem.

Please send a description of the problem and your most recent address label to:

73 Magazine
Subscription Dept.
PO Box 931
Farmingdale, NY 11737

Thank you and enjoy your subscription.

ETCH BOARDS FAST



This Power Etching System will handle PC boards up to 6" x 6". The pump keeps acid agitating for faster, more even etching.

Send $34.50 plus $3.50 for postage and handling to:

STELLMAKER ENTERPRISES ✓32
250 PEQUOT TRAIL
WESTERLY, R.I. 02891

MICROWAVE DISH

- 24" True Parabolic Reflector
- 12" Focus
- Made from .050" Spun Aluminum
- Approximately 21 dBi Gain

$18.95 + $5.00 shipping & handling. Indiana residents please add 4% sales tax

INDY AMATEUR SUPPLY
P.O. Box 421
Indianapolis, IN 46206 ✓6

RED HOT SPECIALS!!

Azden PCS-3000 two-meter	$285
Santec HT 1200 2-m handheld	$279
KDK 2025, MKII, w/TT mike	$269
Janel QSA-5 2-m preamp	$36.50
Bearcat 20-20 Scanner	$278
Kantronics FDII Code Reader	$360
All MFJ items	12% off list
Ten-Tec Argosy Xcvr	$469
Ten-Tec Delta Xcvr	$738
Ten-Tec Omni Xcvr	$1040
Azden PCS-300 2-m handheld	$288
2 only Icom 2KL linear amps	$999
AEA Morsematic	$167
Kantronics Micro RTTY sender	$255
Bencher black paddles	$35

Ben Franklin Electronics
115½ N Main Hillsboro KS 67063
316-947-2269 ✓439

C.B. SPECIAL

(Repeat of a sell out)

CONVERT THESE TO 10 METER FM

New Hy-Gain 40 channel printed circuit boards assembly (Squelch pot, volume control and channel switch not included) Boards sold as is. Dimension 6"X6"

1-9 pcs $7.50 ea.
10-49 pcs $6.50 ea.
(While quantities last)

REMOTE 40 CHANNEL C.B.

Remotes have a metal frame. Speaker, plastic case, and control mic not included. Sold as is. **$14.95 ea**

C.B. BARGAIN

C.B. boards missing parts or damaged. Can be used for spare parts. Buy several!! **$3.50 ea**

Order information: Please add $4.00 for S/H via UPS. COD's accepted for orders totaling $50.00 or more. Florida residents add 4% sales tax. Minimum order $15.00. Foreign orders US funds only add 20% for S/H. MASTER CARD and VISA accepted.

Surplus Electronics Corp.
7294 NW 54th St.
Miami FL 33166 ✓69
P.H.# 305-887-8228

TRS-80® DISCOUNT

1-800-841-0860 TOLL FREE

MICRO MANAGEMENT SYSTEMS INC.
DEPT. NO. 13
Downtown Plaza Shopping Center
115C Second Ave. S.W.
Cairo, Georgia 31728
912-377-7120 Ga. Phone No.

✓313 Write For Free Catalog

RF MODULATORS

Small Size 3¾ x 3 x 1¼ Only **49.95**

- CRYSTAL CONTROLLED FOR STABILITY
- IC CIRCUITRY FOR EXCELLENT RELIABILITY
- EXTERNALLY SWITCHED FOR CHANNELS 3 or 4

The VM-1000 RF Modulator is the same type and quality of those found in todays video tape recorders. It has convenient phono jacks for video and audio inputs and has a standard "F" type connector for RF output. Power is supplied by an AC to DC power pack which is included. Call NOW for more information and for quantity discounts.

JJT DISTRIBUTING ✓25
17210 Yukon Ave., Suite #1
Torrance, Calif. 90504
Call COD Orders to: (213) 515-6800

this publication is available in microform

University Microfilms International

300 North Zeeb Road
Dept. P.R.
Ann Arbor, MI 48106
U.S.A.

18 Bedford Row
Dept. P.R.
London, WC1R 4EJ
England

16-Pole Equalizing RF Processor

New Sherwood SE-2 mike-line speech processor for any transmitter or transceiver. An outgrowth of the Sherwood no-compromise RF/IF processors. Contains built-in SE-1 mike frequency-response equalizer for maximum intelligibility. Easy to install. No transmitter modifications required. Two specially designed 8-pole crystal filters, plus hard, active IC clipping assure excellent talkpower and high processing efficiency. Wide dynamic-range IC balanced modulator and product detector. Audio input/equalizer circuitry works with both high- and low- impedance microphones without overload or distortion. Adjustible clipping 0 to 30 dB or more. Equalization 0 to 20 dB. Versatility, quality, performance; for the amateur who demands the best. Model SE-2: $400.00.

Add $3 shipping per order; $15 overseas air.

Europeans: Please contact Ingoimpex, Postfach 24 49, D-8070, Ingolstadt, West Germany.

Sherwood Engineering Inc.
1268 South Ogden St.
Denver, Colo. 80210
(303) 722-2257

TR-2400 Automatic Band Scanner

for Kenwood TR-2400 stops and locks on busy, or stops and resumes when carrier drops. Controlled by keyboard, no switches to add. Installs easily inside rig, six simple connections, no modifications. Does not use space provided for PL.
Assembled—$24.95 Kit—$14.95

TR-9000 Memory Scanner

for Kenwood TR-9000 scans 5 memory channels. Stops on busy and resumes when carrier drops. Uses existing controls, No switches to add. Installs easily inside rig. See product review Sept. issue *73 Magazine*.
Assembled—$39.95

IC-280 Band Scanner—$29.95

Memory Scanner—$39.95 both for $59.90

- Scanners do not affect normal rig operation.
- Digital readouts display scanned frequency.
- All scanners are easy to install using complete and detailed installation instructions.
- All scanners ASSEMBLED & TESTED (except kit)
- Satisfaction Guaranteed!

Send check or money order to:

ISCAN

28151 W. Mary Ann Rd., Antioch, IL 60002

include $1.50 postage & handling
Illinois res. include 5¼% state tax ✓27

✓See List of Advertisers on page 114

RTTY READER--FROM $149.95

Decodes RTTY signals directly from your receiver's loudspeaker. • **Ideal** for SWLs, novices & seasoned amateurs. • **Completely** solid state and self-contained. Compact size fits almost anywhere. No CRT or demodulator required . . . Nothing extra to buy! • **Built-in** active mark & space filters with tuning LEDs for 170, 425 & 850 Hz FSK. • **Copies** 60, 67, 75, & 100 WPM Baudot & 100 WPM ASCII. • **NOW** you can tune in RTTY signals from amateurs, news sources & weather bulletins. The RTTY READER converts RTTY signals into alphanumeric symbols on an eight-character moving LED readout. Write for details or order factory direct.

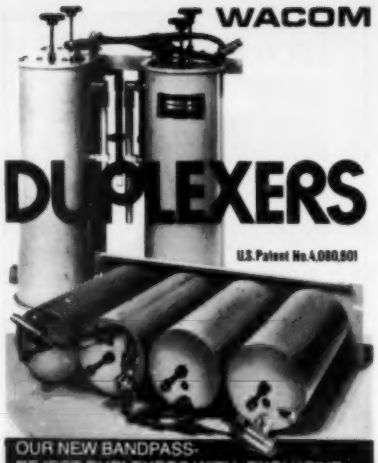
RTTY READER KIT, model RRK . . . . . ~~$169.95~~ $149.95
RTTY READER wired and tested, model RRF . . . . . ~~$249.95~~ $219.95

Send check or money order. Use your VISA or MasterCard. Add $5.00 shipping and handling for continental U.S. Wisconsin residents add 4% Wisconsin State Sales Tax.

~50

Microcraft Corporation Telephone: (414) 241-8144
Post Office Box 513G, Thiensville, Wisconsin 53092

WACOM



DUPLEXERS

U.S. Patent No. 4,080,501

OUR NEW BANDPASS-REJECT DUPLEXERS WITH EXCLUSIVE

B_pB_r CIRCUIT FILTERS®

. . . provides superior performance especially at close frequency spacing.

Models available for all commercial and ham bands
Special prices for amateur repeator clubs.

~79

WACOM PRODUCTS, INC.

P.O. BOX 7127 • WACO, TEXAS 76710
817/848-4435

Radio World

CENTRAL NEW YORK'S MOST COMPLETE HAM DEALER

Featuring Kenwood, Yaesu, Icom, Drake, Ten-Tec, Swan, Dentron, Alpha, Robot, MFJ, Tempo, Astron, KLM, Hy Gain, Mosley, Larsen, Cushcraft, Hustler, Mini Products, Bird, Mirage, Vibroplex, Bencher, Info-Tech, Universal Towers, Callbook, ARRL, Astatic, Shure, Collins, AEA. *We service everything we sell!*

Write or call for quote. **You Won't Be Disappointed.**
We are just a few minutes off the NYS Thruway (I-90) Exit 32

OUT OF STATE ORDER TOLL FREE 800-448-9338

ONEIDA COUNTY AIRPORT TERMINAL BUILDING
ORISKANY, NEW YORK 13424
N.Y. Res. Call (315) 736-0184

~397

Warren - K2IXN
Bob - WA2MSH
Al - WA2MSI

BULLET ELECTRONICS

P.O. BOX 401244E GARLAND, TX 75040 214/278-3553

~12

7 Watt Audio Amp Kit $6.95

SMALL, SINGLE HYBRID IC AND COMPONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS. COMPATIBLE WITH SE-01 SOUND KIT.

Doomsday Alarm Kit $9.95

If you have trouble sleeping and you would like the rest of the neighborhood to share your misery then this little kit will be for you! There is no way to accurately describe the unearthly howls, screams and tones that come out of this kit. Four separate tone oscillators are mixed, cancelled and stepped at a varying rate. 10 Watts of crazy sounds. A great fun kit or a practical burglar alarm. Complete with PC board and all necessary components less speaker. For 6-12 VDC. ORDER DA-02.

New! 3TZ Time Zone Clock Kit

Microprocessor/ROM clock kit keeps local time (12 hour format), and 2 world time zones (24 hour format). Large 6" ORANGE readouts 10 min. ID timer for HAMS. Comes complete with attractive plastic case and wallplug XFMR.

- 6 Digit (hrs., min., sec.)
- 3 Time Zones (Selectable)
- Feathertouch front panel switches
- Seconds Reset/Hold feature
- Quartz XTAL Timebase
- Battery backup
- Quality solder masked and plated PC boards

$54.40

Overvoltage Protection Kit $6.95

Protect your expensive equipment from overvoltage conditions. Every computer should have one! **Works with any fused DC power source** from 10 to 20 volts up to 25 amps.

Sound Effects Kit $18.50

The **SE-01 Sound Effects Kits has** all you need to build a programmable sound effects machine except a battery and speaker. Only the SE-01 provides you with additional circuitry that includes a **Pulse Generator, Mux Oscillator and Comparator** to make more complex sounds a snap. **Includes T178477**, (w/specs) assembly instructions and programming examples. You can easily create **Gunshots, Explosions, Steam Trains, Wind & Surf** and much more.

Complete Kit $18.50
With quality PC Board (Less battery & spkr.)
78477 Chip is included
Extra chips $3.15 ea.

ELECTRONIC MUSIC MAKER

THIS UNIQUE KIT CONTAINS A MICROPROCESSOR CHIP WITH ROM. IT HAS BEEN PROGRAMMED TO PLAY THE FIRST 6 TO 10 NOTES OF THE TUNES LISTED BELOW. CONSTRUCTION IS SIMPLE, WORKS WITH ANY 8 OR 16 OHM SPKR.(NOT INCLUDED). THE KIT WILL OPERATE ON 12VDC OR 12VAC WITH OPTIONAL TRANSFORMER, (CONVERTS TO 117VAC). ALL COMPONENTS & BOARD

Complete Kit $16.95 Transformer $1.35

Tunes: Toreador * William Tell * Hallelujah Chorus * Star Spangled Banner * Yankee Doodle * America * America * Deutschland Lied * Wedding March * Beethoven's 5th and 9th * Hail's Bells * La Viam En Roma * Star Wars Theme * Clementine * Augustine * Jingle Bells * God Save The Queen * Colonel Bogey * Marseillaise * O Sole Mio * Santa Lucia * The End * Blue Danube * Brahms Lullaby * Westminster Chime * Simple Chime * Descending Octave Chime

Regulator Card Kit $14.95

This is the Regulator Card from our famous **20A Power Supply Kit.** Although we ran out of the transformers and heatsinks, many customers have been able to locate their own. The regulator card performs the actual voltage regulation and has adjustable fold back current limiting. Output voltage **is stable to 3000V from 0 to 20 Amps and adjustable** from **11 to 14 Volts.** Designed to drive 2 high current NPN transistors (2N3771 2N5301 or equiv.) The unit assembles quickly. Included are all the on board components including a driver transistor and over-temp shutdown sensor. Designed to screw down to a standard 3" diameter computer grade filter cap. The quality plated PC card is 3-1/2" x 4 3/4".

WITH INSTRUCTIONS

REGULATOR CARD KIT	**$14.95**
HIGH CURRENT PARTS (2 - 2N3772 & 25A Bridge)	**$5.00**
$1,000 MFD @ 40V Computer Grade	$3.50

Requires Transformer with 10 - 10 VAC Out @ The Current You Expect To Draw.

THE SUPER MUSIC MAKER KIT REVISION 2 - $24.95

Now you can play hundreds of songs using the Bullet **Super Music Maker.** The unit **features a single factory programmed microprocessor IC** that comes with 20 pre-programmed short tunes. By adding the additional PROMS (2708's) the system can be expanded to play up to **1000 notes per PROM.** The kit comes with **all electronic components (less the PROMS)**, and a drilled plated and screened PC Board which measures 4" x 4¼". The **7 watt amplifier** section is on the same PC board and drives an 8 ohm speaker (not included). Since the unit works on **12 VDC** or **12 VAC**, vehicle or portable operation is possible. **What do you get for $24.95?** Everything but a speaker, transformer, case switches, and PROM. Additional 2708 PROM's (album containing popular tunes are available for **$9.95** each. Lists of available PROM albums are available on request.

MEMORY CLEARANCE

CA3080 TRANS COND AMP	.88
TLO-82 DUAL BI-FET AMP	.88
CD4584 CMOS - 50/60 CNTR	.99
MC3301 QUAD OP AMP (HSE #)	.44
FPT500 PHOTO TRANSISTOR	.44
TIP 100 NPN DARL 2A IC	.88
TEMP CONTROLLED HOTPLATE 5" x 10" TEMPERED GLASS 110°F to 180°F	1.88
3550 (F8) MICRO P CHIP	2.88
10103 SENSITIVE GATE SCR	3/1.88

Start the new year right...the saving way!

DUAL PHOTO RESISTOR 3/8" DIA	3/.44
2" 8 OHM SPKR. 25 W	2/1.88
AY 3-8910 SOUND EFFECTS	11.88
60 PAGE MANUAL FOR ABOVE	2.88
JUMBO RED LED ASST. STYLES	20/1.88

SUPER SPECIAL DEAL!
STANDARD C-60 CASSETTE NEW, IN PLASTIC CASES. TOP QUALITY ORIG. USED IN DIGITAL APP. FREQ. RESPONSE 300HZ - 10KHZ
1.30 ea. 3/3.50

DIP Switches One 8 pos., One 5 pos. **2.00/Set** (Can be directly soldered to PC Bd. to access tunes)
Battery Switches Two 5 position **2.50/Set** (For remote wiring to PC Bd. to access tunes)
Attractive Tan Plastic Case **5.50**
Wallplug Transformer **3.50** (For operation on 117VAC house voltage)

ORDERING INFORMATION:
Call or Write For Free Catalog

- COD MINIMUM $20.00 • ADD $2.50 FOR COD'S
- UPS DELIVERY ADDRESS MUST ACCOMPANY ALL COD ORDERS
- $1.00 HANDLING ON ORDERS UNDER $10.00
- VISA, MC CARDS ON CHECK
- ADD 6% FOR SHIPPING
- TEXAS RESIDENTS ADD 5% STATE SALES TAX
- ALL FOREIGN ORDERS ADD 25% FOR SHIPPING (CANADA 15%) NO FOREIGN COD'S
- CALL (214) 278-3553 TO PLACE CREDIT CARD OR COD ORDER

GOTHAM ANTENNAS

(813) 584-8489

master charge VISA

~417

SMALL LOT TRAP DIPOLES

MODEL	BANDS	LGTH	PRICE
TSL 8040	80,40	78'	$49.95
TSL 4020	40,20,15	40'	$47.95

SMALL LOT SHORTENED DIPOLES

SL-8010	80,40,20,15,10	75'	$59.95
SL-160	160	130'	$36.95
SL-80	80	63'	$35.95
SL-40	40,15	33'	$34.95

FULL SIZE PARALLEL DIPOLES

FPD-8010	80,40,20,15,10	130'	$49.95
FPD-4010	40,20,15,10	63'	$44.95

NEW! PORTABLE VERTICAL! IDEAL FOR APARTMENTS, CAMPING, TRAILERS!

Folds to 5' Package. No Radials. Required. Fully Assembled. Full Legal Limit. 1:1 VSWR

MODEL	BANDS	HGHT	PRICE
PV-8010	80-10	13'	$59.95

PROVEN DESIGN - GOTHAM ALL BAND VERTICALS

V-160	160,80,40,20,15,10,6	23'	$39.95
V-80	80,40,20,15,10,6	23'	$37.95
V-40	40,20,15,10,6	23'	$35.95

FAMOUS GOTHAM QUADS
2 Elements — 3 Bands Complete $119.95

CHAMPIONSHIP GOTHAM BEAMS
Full Size Complete from $79.95

CALL OR SEND **LARGE** SASE FOR CATALOG. Shipping: Dipoles & Verticals $2.50 USA; $7.00 Canada; $5.00 FPO, APO. Beams & Quads Shipped UPS or Freight Collect. Fla. add 4% Sales Tax

P.O. Box 776 • Largo, FL 33540

Save on Scanners!

NEW Rebates!

Communications Electronics,™ the world's largest distributor of radio scanners, celebrates 1982 with big savings on *Bearcat* scanners. Electra Company, the manufacturers of *Bearcat* scanners is offering consumer rebates on their great line of scanners, when purchased between February 1 and March 15, 1982.

With your scanner, you can monitor the exciting two-way radio conversations of police and fire departments, intelligence agencies, mobile telephones, energy/oil exploration crews, and more. Some scanners can even monitor aircraft transmissions! You can actually hear the news *before* it's news. If you do not own a scanner for yourself, now's the time to buy your new scanner from **Communications Electronics**. Choose the scanner that's right for you, then call our *toll-free* number to place your order with your Visa or Master Card.

We give you excellent service because **CE** distributes more scanners worldwide than *anyone* else. Our warehouse facilities are equipped to process thousands of scanner orders every week. We also export scanners to over 300 countries and military installations. Almost all items are **in stock** for **quick shipment**, so if you're a person who prefers fact to fantasy and who needs to know what's *really* happening around you, order your scanner today from **CE**!

NEW! Bearcat®† 350

The Ultimate Synthesized Scanner!

List price $599.95/**CE price $399.00/$50.00 rebate**
Your final cost is a low $349.00

7-Band, 50 Channel • Alpha-Numeric • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC

Bands: 30-50, 118-136 AM, 144-174, 421-512 MHz.

The new *Bearcat* 350 introduces an incredible breakthrough in synthesized scanning: Alpha-Numeric Display. Push a button—and the Vacuum Fluorescent Display switches from "numeric" to word descriptions of what's being monitored. 50 channels in 5 banks. Plus, Auto & Manual Search, Search Direction, Limit & Count. Direct Channel Access. Selective Scan Delay. Dual Scan Speeds. Automatic Lockout. Automatic Squelch. Non-Volatile Memory. Order your *Bearcat* 350 today!

Bearcat® 300

List price $549.95/**CE price $349.00/$50.00 rebate**
Your final cost is a low $299.00

7-Band, 50 Channel • Service Search • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC

Bands: 32-50, 118-136 AM, 144-174, 421-512 MHz.

The *Bearcat* 300 is the most advanced automatic scanning radio that has ever been offered to the public. The *Bearcat* 300 uses a bright green fluorescent digital display, so it's ideal for mobile applications. The *Bearcat* 300 now has these added features: Service Search, Display Intensity Control, Hold Search and Resume Search keys, Separate Band keys to permit lock-in/lock-out of any band for more efficient service search.

NEW! Bearcat® 350

FREE Bearcat® Rebate Offer

Get a coupon good for a $50 rebate when you purchase a *Bearcat* 350 or 300; $25 rebate on model 250 or 20/20; $15 rebate on model 210XL; $10 rebate on model 160 or 4-6 Thin Scan. To get your rebate, mail rebate coupon with your original dated sales receipt and the *Bearcat* model number from the carton to Electra. You'll receive your rebate in four to six weeks. Offer valid only on purchases made betwen February 1, 1982 and March 15, 1982. All requests must be postmarked by March 31, 1982. Limit of one rebate per household. Coupon must accompany all rebate requests and may not be reproduced. Offer good only in the U.S.A. Void where taxed or prohibited by law. Resellers, companies, clubs and organizations–both profit and non-profit–are not eligible for rebates. Employees of Electra Company, their advertising agencies, distributors and retailers of *Bearcat* Scanners are also not eligible for rebates. Please be sure to send in the correct amount for your scanner. Pay the listed **CE** price in this ad. *Do not* deduct the rebate amount since your rebate will be sent directly to you from Electra. Orders received with insufficient payments will not be processed and will be returned. Offer subject to change without notice.

Bearcat® 250

List price $429.95/**CE price $279.00/$25.00 rebate**
Your final cost is a low $254.00

6-Band, 50 Channel • Crystalless • Searches Stores • Recalls • Digital clock • AC/DC Priority Channel • 3-Band • Count Feature.

Frequency range 32-50, 146-174, 420-512 MHz.

The *Bearcat* 250 performs any scanning function you could possibly want. With push button ease you can program up to 50 channels for automatic monitoring. Push another button and search for new frequencies. There are no crystals to limit what you want to hear. A special search feature of the *Bearcat* 250 actually stores 64 frequencies and recalls them, one at a time, at your convenience.

NEW! Bearcat® 20/20

List price $449.95/**CE price $289.00/$25.00 rebate**
Your final cost is a low $264.00

7-Band, 40 Channel • Crystalless • Searches AM Aircraft and Public Service bands • AC/DC Priority Channel • Direct Channel Access • Delay

Frequency range 32-50, 118-136 AM, 144-174, 420-512 MHz.

The *Bearcat* 20/20 automatic scanning radio replaces the *Bearcat* 220 and monitors 40 frequencies from 7 bands, including aircraft. A two-position switch, located on the front panel, allows monitoring of 20 channels at a time.

Bearcat® 210XL

List price $349.95/**CE price $229.00/$15.00 rebate**
Your final cost is a low $214.00

6-Band, 18 Channel • Crystalless • AC/DC

Frequency range: 32-50, 144-174, 421-512 MHz.

The *Bearcat* 210XL scanning radio is the second generation scanner that replaces the popular *Bearcat* 210 and 211. It has almost twice the scanning capacity of the *Bearcat* 210 with 18 channels plus dual scanning speeds and a bright green fluorescent display. Automatic search finds new frequencies. Features scan delay, single antenna, patented track tuning and more!

Bearcat® 160

List price $299.95/**CE price $194.00/$10.00 rebate**
Your final cost is a low $184.00

5-Band, 16 Channel • AC only • Priority Dual Scan Speeds • Direct Channel Access

Frequency range: 32-50, 144-174, 440-512 MHz.

The *Bearcat* 160 is the least expensive *Bearcat* crystalless scanner. Smooth keyboard. No buttons to punch. No knobs to turn. Instead, finger-tip pads provide control of *all* scanning operations.

NEW! Bearcat® 100

The first no-crystal programmable handheld scanner.

Allow 30-120 days for delivery after receipt of order due to the high demand for this product.

List price $449.95/**CE price $299.00**

8-Band, 16 Channel • Liquid Crystal Display Search • Limit • Hold • Lockout • AC/DC

Frequency range: 30-50, 138-174, 406-512 MHz.

The world's first no-crystal handheld scanner has compressed into a 3" x 7" x 1¾" case more scanning power than is found in many base or mobile scanners. The *Bearcat* 100 has a full 16 channels with frequency coverage that includes all public service bands (Low, High, UHF and "T" bands), the 2-Meter and 70 cm. Amateur bands, *plus* Military and Federal Government frequencies. It has chrome-plated keys for functions that are user controlled, such as lockout, manual and automatic scan. Even search is provided, both manual and automatic. Wow...what a scanner!

The *Bearcat* 100 produces audio power output of 300 milliwatts, is track-tuned and has selectivity of better than 50 dB down and sensitivity of 0.6 microvolts on VHF and 1.0 microvolts on UHF. Power consumption is kept extremely low by using a liquid crystal display and exclusive low power integrated circuits.

Included in our low **CE** price is a sturdy carrying case, earphone, battery charger/AC adapter, six AA ni-cad batteries and flexible antenna. For earliest delivery from **CE**, reserve your *Bearcat* 100 today.

TEST ANY SCANNER

Test any scanner purchased from **Communications Electronics**™ for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges and rebate credits).

Bearcat® Four-Six ThinScan™

List price $189.95/**CE price $124.00/$10.00 rebate**
Your final cost is a low $114.00

Frequency range: 33-47, 152-164, 450-508 MHz.

The incredible, *Bearcat* Four-Six Thin Scan™ is like having an information center in your pocket. This four band, 6 channel crystal controlled scanner has patented Track Tuning on UHF. Scan Delay and Channel Lockout. Measures 2¾ x 6¼ x 1." Includes rubber ducky antenna. Order crystal certificate for each channel. Made in Japan.

Fanon Slimline 6-HLU

List price $169.95/**CE price $109.00**

Low cost 6-channel, 3-band scanner!

The *Fanon* Slimline 6-HLU gives you six channels of crystal controlled excitement. Unique Automatic Peak Tuning Circuit adjusts the receiver front end for maximum sensitivity across the entire UHF band. Individual channel lockout switches. Frequency range 30-50, 146-175 and 450-512 MHz. Size 2¾ x6¼ x 1." Includes rubber ducky antenna. If you *don't* need the UHF band, get the **Fanon model 6-HL** for $99.00 each, and save money. Same high performance and features as the model HLU without the UHF band. Order crystal certificates for each channel. Made in Japan.

OTHER SCANNERS & ACCESSORIES

NEW! **Regency‡ D810 Scanner**	$319.00
NEW! **Rgency‡ D300 Scanner**	$219.00
NEW! **Regency‡ D100 Scanner**	$169.00
NEW! **Regency‡ H604 Scanner**	$129.00
Regency‡ M400 Scanner	$259.00
Regency‡ M100 Scanner	$199.00
Regency‡ R1040 Scanner	$149.00
SCMA-6 Fanon Mobile Adapter/Battery Charger	$49.00
CHB-6 Fanon AC Adapter/Battery Charger	$15.00
CAT-6 Fanon carrying case with belt clip	$15.00
AUC-3 Fanon auto lighter adapter/Battery Charger	$15.00
PSK-6 Base Power Supply/Bracket for SCMA-6	$20.00
SP50 *Bearcat* AC Adapter	$9.00
SP51 *Bearcat* Battery Charger	$9.00
SP58 *Bearcat* 4-6 ThinScan™ carrying case	$12.00
MA506 *Regency* carrying case for H604	$15.00
FB-E Frequency Directory for Eastern U.S.A.	$12.00
FB-W Frequency Directory for Western U.S.A.	$12.00
FFD Federal Frequency Directory for U.S.A.	$12.00
TSG "Top Secret" Registry of U.S. Government Freq.	$10.00
ASD Frequency Directory for Aircraft Band	$10.00
B-4 1.2 V AAA Ni-Cad batteries (set of four)	$9.00
A-135cc Crystal certificate	$3.00

Add $3.00 shipping for all accessories ordered at the same time.

INCREASED PERFORMANCE ANTENNAS

If you want the utmost in performance from your scanner, it is essential that you use an external antenna. We have six base and mobile antennas specifically designed for receiving all bands. Order **#A60** is a magnet mount mobile antenna. Order **#A61** is a gutter clip mobile antenna. Order **#A62** is a trunk-lip mobile antenna. Order **#A63** is a ¾ inch hole mount. Order **#A64** is a ⅜ inch snap-in mount, and **#A70** is an all band base station antenna. All antennas are $35.00 and $3.00 for UPS shipping in the continental United States.

BUY WITH CONFIDENCE

To ***get the fastest delivery from CE*** of any scanner, send or phone your order directly to our "Scanner Distribution Center." Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability, acceptance and verification. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. Most products that we sell have a manufacturer's warranty. Free copies of warranties on these products are available prior to purchase by writing to CE. International orders are invited with a $20.00 surcharge for special handling *in addition* to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance. Minimum order $35.00.

Mail orders to: **Communications Electronics,™** Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add $7.00 per scanner or phone product for U.P.S. *ground* shipping and handling, or $14.00 for faster U.P.S. *air* shipping to some locations. If you have a Visa or Master Card, you may call anytime and place a credit card order. **Order toll free** in the U.S.A. Dial 800-521-4414. If you are outside the U.S. or in Michigan, dial 313-994-4444. **Dealer inquiries invited.** Order without obligation today!

Scanner Distribution Center™ and CE logos are trademarks of Communications Electronics.™

†*Bearcat* is a federally registered trademark of Electra Company, a Division of Masco Corporation of Indiana.

‡*Regency* is a federally registered trademark of Regency Electronics Inc.

AD #1121081

Copyright ©1982 Communications Electronics™

CODE OF ETHICS | VISA | MasterCard

377

COMMUNICATIONS ELECTRONICS™

854 Phoenix ☐ Box 1002 ☐ Ann Arbor, Michigan 48106 U.S.A.
Call TOLL-FREE (800) 521-4414 or outside U.S.A. (313) 994-4444

MHz electronics

(602) 242-3037
(602) 242-8916
2111 W. CAMELBACK ROAD
PHOENIX, ARIZONA 85015

Introducing

TVRO CIRCUIT BOARDS

Satellite Receiver Boards—Now in Stock

DUAL CONVERSION BOARD.....**$25.00**
This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages.

SIX 47pF CHIP CAPACITORS
For use with dual conversion board.....**$6.00**

70 MHz IF BOARD.....**$25.00**
This circuit provides about 43dB gain with 50 ohm input and output impedance. It is designed to drive the HOWARD/COLEMAN TVRO Demodulator. The on-board bandpass filter can be tuned for bandwidths between 20 and 35 MHz with a passband ripple of less than ½ dB. Hybrid IC's are used for the gain stages.

SEVEN .01 pF CHIP CAPACITORS
For use with the 70 MHz IF board.....**$7.00**

DEMODULATOR BOARD.....**$40.00**
This circuit takes the 70 MHz center frequency satellite TV signals in the 10 to 200 millivolt range, detects them using a phase locked loop, de-emphasizes and filters the result and amplifies the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC.

SINGLE AUDIO.....**$15.00**
This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8 MHz subcarrier and the Miller 9052 coil tunes for recovery of the audio.

DUAL AUDIO.....**$25.00**
Duplicate of the single audio but also covers the 6.2 range.

DC CONTROL.....**$15.00**

SPECIAL SET OF FIVE BOARDS.....**$100.00**
INCLUDING DUAL AUDIO (2 single audio boards)

1900 to 2500 MHz MICROWAVE DOWNCONVERTER

MICROWAVE RECEIVER This receiver is tunable over a range of 1900 to 2500 MHz approximately, and is intended for amateur use. The local oscillator is voltage controlled, making the I.F. range approximately 54 to 88 MHz for standard TV set channels 2 thru 7.

P.C. BOARD with DATA 1 to 5 **$15.00** 6 to 11 **$13.00** 12 to 26 **$11.00** 27 - up **$9.00**

P.C. Board with all parts for assembly.....**$49.99**
P.C. Board with all parts for assembly plus 2N6603.....**$69.99**
P.C. Board with all chip caps soldered on...**$30.00**
P.C. Board assembled & tested.....**$69.99**
P.C. Board assembled & tested with 2N6603**$79.99**

HMR II DOWNCONVERTER with Power Supply, Antenna (Dish) & all Cables for installation. 180 Day Warranty.
1 to 5 **$150.00** 6 to 11 **$140.00** 12 - up **$125.00**

YAGI DOWNCONVERTER with Power Supply, Antenna (Yagi) & all Cables for installation. 90 Day Warranty.
1 to 5 **$150.00** 6 to 11 **$140.00** 12 - up **$125.00**

YAGI DOWNCONVERTER as above but Kit. (NO CABLES) With Box.
1 to 5 **$125.00** 6 to 11 **$115.00** 12 - up **$100.00**

HMR II DOWNCONVERTER as above but Kit. (NO CABLES) With PVC.
1 to 5 **$125.00** 6 to 11 **$115.00** 12 - up **$100.00**

SPECIAL NEW STOCK OF CARBIDE DRILL BITS—YOUR CHOICE $1.99

1.25mm	13/64	36	47	55	63
1.45mm	19	37	48	56	64
3.2mm	20	38	49	57	65
3.3mm	24	39	50	58	67
1/8	26	40	51	59	68
3/16	29	44	52	60	69
5/32	30	45	53	61	
7/32	31	46	54	62	

"DOWN CONVERTERS"

1900 to 2500 MHZ Microwave Downconverters

In Regards to your request for information concerning our microwave receiver. This receiver is tunable over a range of 1900 to 2500 MHZ approximately,and is intended for amateur use. The local oscillator is voltage controlled (i.e.) making the I.F. range approximately 54 to 88 MHZ For Your Standard TV Set Channels 2 thru 7.

P.C.Board with Data

1 to 5	$15.00	6 to 11	$13.00	12 to 26	$11.00	27 up	$9.00

P.C.Board with all chip caps solder on. $30.00

P.C.Board with all parts for assembly. $49.99

P.C.Board with all parts for assembly plus 2N6603 $69.99

P.C.Board assembled and Tested. $69.99

P.C.Board assembled and Tested with 2N6603. $79.99

HMR II Downconverter with power supply — antenna (Dish)
180 Day Warranty .

1 to 5	$150.00	6 to 11	$140.00	12 to up	$125.00

Yagi Downconverter with Power Supply , Antenna (Yagi) and all cables for Instalation. 90 Day Warranty.

1 to 5	$150.00	6 to 11	$140.00	12 up	$125.00

Yagi Downconverter as above but Kit. (NO CABLES) With Box.

1 to 5	$125.00	6 to 11	$115.00	12 up	$100.00

HMR II Downconverter as above but Kit. (NO CABLES) With PVC.

1 to 5	$125.00	6 to 11	$115.00	12 up	$100.00

Special New Stock Of Carbide Drill Bits.

1.25mm	20	40	53	63
1.45mm	24	44	54	64
3.2mm	26	45	55	65
3.3mm	29	46	56	67
1/8	30	47	57	68
3/16	31	48	58	69
5/32	36	49	59	
7/32	37	50	60	Your Choice $1.99
13/64	38	51	61	
19	39	52	62	

Toll Free Number
800-528-0180
(For orders only)

MHz electronics

159

"FILTERS"

Collins Mechanical Filter #526-9724-010 Model F455Z32F
455KHz at 3.2KHz Wide. $15.00

Atlas Crystal Filters

5.52-2.7/8	5.52MHz/2.7KHz wide 8 pole	
5.595-2.7/8/U	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.595-.500/4/CW	5.595MHz/.500KHz wide 4 pole CW	
5.595-2.7/LSB	5.595MHz/2.7KHz wide 8 pole lower sideband	
5.595-2.7/USB	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.645-2.7/8	5.645MHz/2.7KHz wide 8 pole	Your Choice
9.0SB/CW	9.0MHz/ 8 pole sideband and CW	$12.99

Kokusai Electric Co. Mechanical Filter #MF-455-ZL-21H
455KHz at Center Frequency of 453.5Kc Carrier Frequency of 455Kc 2.36Kc Bandwidth
$15.00

Crystal Filters

Nikko	FX-07800C	7.8MHz	10.00
TEW	FEC-103-2	10.6935	10.00
Tyco/CD	001019880	10.7MHz 2 pole 15KHz Bw. Motorola #48D84396K01 Thru #48D84396K05	4.00
Motorola	4884863B01	11.7MHz 2 pole 15KHz Bandwidth	5.00
PTI	5350C	12MHz 2 pole 15KHz Bandwidth	5.00
PTI	5426C	21.4MHz 2 pole 15KHz Bandwidth	5.00
CD	A10300	45MHz 2 pole 15KHz Bandwidth (For Motorola Communications equipment)	5.00

Ceramic Filters

Murata	BFB455B	455KHz	$ 2.40
	CFM455E	455KHz +- 5.5KHz	6.65
	CFM455D	455KHz +- 7KHz	6.65
	CFR455E	455KHz +- 5.5KHz	8.00
	CFU455E	455KHz +- 1.5KHz	2.90
	CFU455G	455KHz +- 1KHz	2.90
	CFW455D	455KHz +- 1KHz	2.90
	CFW455H	455KHz +- 3KHz	4.35
	SFB455D	455KHz	2.40
	SFE10.7	10.7MHz	2.67
	SFG10.7MA	10.7MHz	10.00
Clevite	TO-01A	455KHz	5.00
	TO-02A	455KHz	5.00
Nippon	LF-B4/CFU455I	455KHz +- 1KHz	5.80
	LF-B6/CFU455H	455KHz +- 1KHz	5.80
	LF-C18	455KHz	10.00
Tokin	CF455A/BFU455K	455KHz +- 2KHz	4.80
Matsushira	EFC-L455K	455KHz	7.00

ROTRON MUFFIN FANS Model Mark 4/MU2A1
These fans are new factory boxed 115vac at 14watts 50/60cps. Impedance Protected-F
CFM is 88 at 50cps and 105 at 60cps. $ 7.99

SPECTRA PHYSICS INC. Model 088 HeNe Laser Tubes.
Power output 1.6mw. Beam Dia. .75mm. Beam Dir. 2.7mr. 8Kv starting voltage
68K ohm 1watt ballast 1000vdc +-100vdc 3.7ma. TUBES ARE NEW $59.99

"AMPLIFIERS"

AVANTEK LOW NOISE AMPLIFIERS

Models	UTC2-102M	AP-20-T	AL-45-0-1	AK-1000M
Frequency Range	30 to 200MC	200 to 400MC	450 to 800MC	500 to 1000MC
Noise Figure	1.5dB	6.5dB	7dB	2.5dB
Voltage	+15vdc	+24vdc	-6vdc @ +12vdc	+12vdc @ -12vdc
Gain	29dB	30dB	30dB	25dB
Power Output	1dB Gain +7dBm	1dB Gain +20dBm	1dB Gain -5dBm	1dB Gain +8dBm
Price	$49.99	$49.99	$49.99	$69.99

Mini Circuits Double Balanced Mixers

Model RAY-3
Very High Level (+23dBm LO) 70KHz to 200MHz LO,RF,DC to 200MHz IF
Conversion Loss,dB One Octave From Band Edge 6Typ./7.5Max. Total Range 6.5Typ./8Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 55Typ./45Min. Mid. Range (LO-RF/LO-IF) 40Typ./30Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 30Typ./25Min.
Price $24.99

Model TSM-3
Standard Level (+7dBm LO) .1MHz to 400MHz LO,RF,DC to 400MHz IF
Conversion Loss,dB One Octave From Band Edge 5.3Typ./7.5Max. Total Range 6.5Typ./8.5Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 60Typ./50Min. Mid. Range (LO-RF/LO-IF) 50Typ./35Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 35TYP./25Min.
Price $11.99

Hewlett Packard Linear Power Microwave RF Transistor HXTR5401/35831E

Collector Base Brakedown Voltage at Ic=100ua	35volts min.
Collector Emitter Brakedown Voltage at Ic=500ua	30volts min.
Collector Cutoff Current at Vcb=15v	100ua max.
Forward Current Transfer Ratio at Vce=15v,Ic=15ma	15min,40typ,125max
Transducer Power Gain at Vce=18v,Ice=60ma,F=2GHz.	3dBmin,4dBtyp
Maximum Available Gain at Vce=18v,Ic=60ma,F=1GHz/F=2GHz	14dB typ,8dB typ
Price	$29.99

Motorola RF Power Amplifier Modules

Model	MHW612A	MHW613A	MHW710	MHW720
Frequency Range	146 to 147MHz	150 to 174MHz	400 to 512MHz	400 to 470MHz
Voltage	12.5vdc	12.5vdc	12.5vdc	12.5vdc
Output Power	20watts	30watts	13watts	20watts
Minimum Gain	20dB	20dB	19.4dB	21dB
Harmonics	-30dB	-30dB	40dB	40dB
RF Input Power	400mw	500mw	250mw	250mw
Price	$57.50	$59.80	$57.50	$69.00

Toll Free Number
800-528-0180
(For orders only)

MHz electronics

See List of Advertisers on page 114

"TRANSISTORS"

WATKINS JOHNSON WJ-M62 3.7 to 4.2GHz Communication Band Double Balanced Mixer $100.00

SSB Conversion Loss	4.9dB Typ. 6dB Max.		fR 3.7 to 4.2GHz	
	5.5dB Typ. 6.5dB Max.		fI DC to 1125MHz fL fR	
			fI 880MHz fL fR	
SSB Noise Fiqure			fR 3.7 to 4.2GHz	
	4.9dB Typ. 6dB Max.		fI 30 to 1125MHz fL fR	
	5.5dB Typ. 6.5dB Max.		fI 880MHz fL fR	
Isolation				
fL at R	30dB Min. 40dB Typ.		fL 2.8 to 5.35GHz	
fL at I	25dB Min. 30dB Typ.		fL 4.5 to 5.35GHz	
	20dB Min. 30dB Typ.		fL 3.6 to 4.5GHz	
	15dB Min. 25dB Typ.		fL 2.8 to 3.6GHz	
Conversion Compression	1dB Max.		fR Level +2dBm	
Flatness	.2dB Peak to Peak Over any 40MHz Segment of fR=3.7 to 4.2GHz			
Third Order Input Intercept	+11dBm		fR1=4GHz fR2=4.01GHz Both at -5dBm fL=4.5GHz	
Group Time Delay	.5ns Typ. .75ns Max.		fR3.7 to 4.2GHz fL 3480MHz	@ +13dBm
VSWR	L-Port	1.25:1 Typ.	2.0:1	fL 2.8 to 5.35GHz
	R-Port	1.25:1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
		1.4 :1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
	I-Port	1.5 :1 Typ.	2.0:1	fI=100MHz
		1.3 :1 Typ.	2.0:1	fI=500MHz
		1.8 :1 Typ.	2.5:1	fI=1125MHz

SGS/ATES RF Transistors			Motorola RF Transistor	
Type.	BFQ85	BFW92	MRF901	2N6603
Collector Base V	20v	25v	25v	25v
Collector Emitter V	15v	15v	15v	15v
Emitter Base V	3v	2.5v	3v	3v
Collector Current	40ma	25ma	30ma	30ma
Power Dissipation	200mw	190mw	375mw	400mw
HFE	40min. 200max.	20min. 150max.	30min. 200max.	30min. 200max.
FT	4GHZ min. 5GHz max.	1.6GHz Typ.	4.5GHz typ.	2GHz min.
Noise Fiqure	1GHz 3dB Max.	500MHz 4dB Typ.	1GHz 2dB Typ.	2GHz 2.9dB Typ.
Price	$1.50	$1.50	$2.00	$10.00

National Semiconductor Variable Voltage Regulator Sale !!!!!!!!!

LM317K	LM350K	LM723G/L	LM7805/06/08/12/15/18/24
1.2 to 37vdc	1.2 to 33vdc	2 to 37vdc	5, 6, 8,12,15,18,24vdc
1.5Amps	3Amps	150ma.	1Amp
TO-3	TO-3	TO-100/TO-116	TO-220/TO-3
$4.50	$5.75	$1.00 $1.25	$1.17 $2.00

P & B Solid State Relays Type ECT1DB72

5VDC Turn On 120VAC Contact 7Amps
20Amps on 10"x10"x.062" Alum.Heatsink with
Silicon Grease $5.00

*May Be Other Brand Equivalent

Toll Free Number
800-528-0180
(For orders only)

MHz electronics

"MIXERS"

WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above 8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min F=2GHz	dB 2.4 Typ.	MAG F=2GHz	dB 12 Typ.	$5.30
F=3GHz	dB 3.4 Typ.	F=3GHz	dB 9 Typ.	
F=4GHz	dB 4.3 Typ.	F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacutures and described in the Motorola RF Data Book.

10pf	22pf	30pf	40pf	100pf	250pf	1 to 10pcs. .60¢ each
13pf	25pf	32pf	43pf	120pf	820pf	11 to 50pcs. .50¢ each
14pf	27pf	33pf	62pf	180pf		51 to 100pcs. .40¢ each
20pf	27.5pf	34pf	80pf	200pf		

NIPPON ELECTRIC COMPANY TUNNEL DIODES $7.50

		MODEL 1S2199	1S2200
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ration (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

List all Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

PRICE $7.50

Toll Free Number
800-528-0180
(For orders only)

MHz electronics

See List of Advertisers on page 114

"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$ POR	SK626	Chimney	$ 7.70
SK406	Chimney	35.00	SK630	Socket	45.00
SK416	Chimney	22.00	SK636B	Chimney	26.40
SK500	Socket	330.00	SK640	Socket	27.50
SK506	Chimney	47.00	SK646	Chimney	55.00
SK600	Socket	39.50	SK711A	Socket	192.50
SK602	Socket	56.00	SK740	Socket	66.00
SK606	Chimney	8.80	SK770	Socket	66.00
SK607	Socket	43.00	SK800A	Socket	150.00
SK610	Socket	44.00	SK806	Chimney	30.80
SK620	Socket	45.00	SK900	Socket	253.00
SK620A	Socket	50.50	SK906	Chimney	44.00

JOHNSON TUBE SOCKETS

124-115-2/SK620A	Socket	$ 30.00	124-113	Bypass Cap.	$ 10.00
124-116/SK630A	Socket	40.00	122-0275-001	Socket (For 4-250A,4-400A,3-400Z, 3-500Z)	10.00 2/$15.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

Toll Free Number
800-528-0180
(For orders only)

MHz electronics

"TUBES"

TUBES	PRICE
2E26	$ 4.69
2K28	100.00
3B28	5.00
3-500Z	102.00
3-1000Z/8164	300.00
3CX1000A/8283	200.00
3X2500A3	200.00
4-65A/8165	45.00
4-125A/4D21	58.00
4-250A/5D22	68.00
4-400A/8438	71.00
4-400C/6775	80.00
4-1000A/8166	300.00
4CS250R	69.00
4X150A/7034	30.00
4X150D/7035	40.00
4X150G	50.00
4X250B	30.00
4CX250B/7203	45.00
4CX250F/7204	45.00
4CX250FG/8621	55.00
4CX250K/8245	100.00
4CX250R/7580W	69.00
4CX300A	99.00
4CX350A/8321	100.00
4CX350FJ/8904	100.00
4X500A	100.00
4CX600J	300.00
4CX1000A/8168	300.00
4CX1500B/8660	300.00
4CX3000A/8169	300.00
4CX5000A/8170	400.00
4CX10000D/8171	500.00
4CX15000A/8281	700.00
4E27/A/5-123A/B	40.00
4PR60A	100.00
4PR60B/8252	175.00
KT88	15.00
DX362	35.00
DX415	35.00
572B/T160L	44.00
811	10.00
811A	13.00
812A	15.00
813	38.00
4624	100.00
4665	350.00
5551A	100.00
5563A	77.00
5675	15.00
5721	$200.00
5768	85.00
5836	100.00
5837	100.00
5861/EC55	110.00
5876A	15.00
5881/6L6	5.00
5894/A	45.00
5894B	55.00
6080	10.00
6083/AX9909	89.00
6098/6AK6	14.00
6115/A	100.00
6146	6.00
6146A	6.50
6146B/8298A	7.50
6146W	14.00
6159	11.00
6161	70.00
6291	125.00
6293	20.00
6360	4.00
6524	53.00
6550	7.00
6562/6794A	25.00
6693	110.00
6816	58.00
6832	22.00
6883/8032A/8552	7.00
6884	46.00
6897	110.00
6900	35.00
6907	55.00
6939	15.00
7094	75.00
7117	17.00
7211	60.00
7289/3CX100A5	34.00
7360	11.00
7377	67.00
7486	75.00
7650	250.00
7843	58.00
7868	4.00
7984	12.00
8072	55.00
8121	50.00
8122	85.00
8236	30.00
8295/PL172	300.00
8462	$100.00
8505A	73.50
8533W	92.00
8560A	55.00
8560AS	57.00
8608	34.00
8624	67.20
8637	38.00
8647	123.00
8737/5894B	55.10
8807	1000.00
8873	260.00
8874	260.00
8875	260.00
8877	533.00
8908	12.00
8916	1500.00
8930/X651Z	45.00
8950	10.00
6BK4C	5.00
6DQ5	4.00
6FW5	5.00
6GE5	5.00
6GJ5	5.00
6HS5	5.00
6JB5/6HE5	5.00
6JB6A	5.00
6JM6	5.00
6JN6	5.00
6JS6B	5.00
6JT6A	5.00
6KD6	5.00
6K66/EL505	5.50
6KM6	5.00
6KN6	5.00
6LF6	6.00
6LQ6	6.00
6LU8	5.00
6LX6	5.00
6ME6	5.00
12JB6A	6.00

"WE ARE ALSO LOOKING FOR TUBES NEW/USED ECT."

WE BUY SELL OR TRADE

NOTICE ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE !!

Toll Free Number
800-528-0180
(For orders only)

MHz electronics

See List of Advertisers on page 114

"MICROWAVE COMPONENTS"

		MICROWAVE COMPONENTS	
AIL	70A	Noise Source	$100.00
AIL	7010	Noise Source .2 to 2.6GHz	100.00
AIL	07050	Noise Source	100.00
AIL	07051	Noise Source 7.05 to 10GHz	150.00
AIL	07091	Noise Source 12.4 to 18GHz	200.00
ARRA	KU520A	Variable Attenuator	100.00
ARRA	2416-20	Variable Attenuator 0-20dB .5 to 1GHz 1W	50.00
ARRA	3614-60I	Variable Attenuator 0-60dB 1 to 2GHz 1W	50.00
ARRA	4604-20C	Variable Attenuator 0-20dB 3 to 4GHz 1W	75.00
ARRA	6004-20F	Variable Attenuator 0-20dB 7 to 11GHz	75.00
Alfred	1151	Sampler Attenuator 1 to 2GHz 0 to 50dB	200.00
Alfred	1152	Sampler Attenuator 2 to 4GHz 0 to 50dB	200.00
Alfred	1153	Sampler Attenuator 4 to 8GHz 0 to 50dB	200.00
American	2000-6254	Adapter X to SMA 8.2 to 12.4GHz	75.00
American	2020-6600	Directional Coupler .5 to 1GHz 6dB	75.00
Bounton	41-4B	Power Detector	75.00
Coaxial Dynamics	3023	Directional Power Detector 60wfwd/15wrev/225-400mc	50.00
Coaxial Dynamics	3025	Directional Power Detector 60wfwd/15wrev/116-150mc	50.00
FXR/Microlab	CM-A21	Coupler	35.00
FXR/Microlab	XP-A39	Crystal Detector	35.00
FXR/Microlab	S164A	Variable Attenuator 0-50dB 2.6 to 3.95GHz	450.00
FXR/Microlab	N414A	Frequency Meter 3.95 to 11GHz	450.00
FXR/Microlab	601A07	Adapter	35.00
FXR/Microlab	G601B	Adapter	35.00
General Microwave	N402A-3	Power Detector	100.00
General Microwave	N710-20	Directional Coupler 2 to 4GHz 20dB	75.00
General Microwave	4276-2	100:1 Divider 1MC to 250MC	35.00
Hewlett Packard	G281A	Adapter G to N 3.95 to 5.85Gc	50.00
Hewlett Packard	H281A	Adapter H to N 7.05 to 10Gc	35.00
Hewlett Packard	X281A	Adapter X to N 8.2 to 12.4Gc	35.00
Hewlett Packard	MX292B	Adapter 10 to 15Gc	75.00
Hewlett Packard	NX292A	Adapter 15 to 22Gc	75.00
Hewlett Packard	349B	Noise Source IF 30/60Mc	200.00
Hewlett Packard	G347A	Noise Source 3.95 to 5.85Gc	250.00
Hewlett Packard	H347A	Noise Source 7.05 to 10Gc	250.00
Hewlett Packard	S347A	Noise Source 2.6 to 3.95Gc	325.00
Hewlett Packard	X347A	Noise Source 8.2 to 12.4Gc	250.00
Hewlett Packard	349A	Noise Source 400Mc to 4Gc	300.00
Hewlett Packard	355C	Variable Attenuator .5w DC to 1Gc	150.00
Hewlett Packard	360B	Low Pass Filter 4100Mc	50.00
Hewlett Packard	G382A	Variable Attenuator 0 to 50dB 3.95 to 5.85Gc	500.00
Hewlett Packard	J382A	Variable Attenuator 0 to 50dB 5.85 to 8.2Gc	500.00
Hewlett Packard	P382A	Variable Attenuator 0 to 50dB 12.4 to 18Gc	350.00
Hewlett Packard	X382A	Variable Attenuator 0 to 50dB 8.2 to 12.4Gc	325.00
Hewlett Packard	411A-21D	N Tee For 411A	35.00
Hewlett Packard	H421A	Crystal Detector 7.05 to 10Gc	50.00
Hewlett Packard	H421A	Crystal Detector 7.05 to 10Gc Matched Pair	200.00
Hewlett Packard	H424A	Crystal Detectot 7.05 to 10Gc Matched Pair	400.00
Hewlett Packard	477B	Thermistor Mount For 430 Series 10Mc to 10Gc	75.00
Hewlett Packard	G485A	Barrettor Mount 1.9% to 5.85Gc	88.00
Hewlett Packard	J485B	Detector Mount 5.85 to 8.2Gc	85.00
Hewlett Packard	J486A	Thermistor Mount 5.85 to 8.2Gc	180.00
Hewlett Packard	H487B	Thermistor Mount 7.05 to 10Gc	50.00
Hewlett Packard	K487C	Thermistor Mount 18 to 26Gc	135.00
Hewlett Packard	P487B	Thermistor Mount 12.4 to 18Gc	155.00
Hewlett Packard	X487A	Thermistor Mount 8.2 to 12.4Gc	65.00
Hewlett Packard	X487B	Thermistor Mount 8.2 to 12.4Gc	85.00
Hewlett Packard	G532A	Frequency Meter 3.95 to 5.85Gc	300.00
Hewlett Packard	H532A	Frequency Meter 7.05 to 10Gc	500.00
Hewlett Packard	J532A	Frequency Meter 5.3 to 8.2Gc	400.00
Hewlett Packard	M532A	Frequency Meter 10 to 15Gc	500.00
Hewlett Packard	P532A	Frequency Meter 12.4 to 18Gc	400.00
Hewlett Packard	X532A	Frequency Meter 8.2 to 12.4Gc	350.00
Hewlett Packard	536A	Frequency Meter .94 to 4.2Gc	600.00
Hewlett Packard	G752D	Directional Coupler 20dB 3.95 to 5.85Ga	200.00
Hewlett Packard	X752A	Directional Coupler 3dB 8.2 to 12.4Gc	200.00
Hewlett Packard	X752C	Directional Coupler 10dB 8.2 to 12.4Gc	200.00
Hewlett Packard	X752D	Directional Coupler 20dB 8.2 to 12.4Gc	200.00
Hewlett Packard	766D	Dual Directional Coupler .94 to 1.975Gc 20dB	50.00
Hewlett Packard	767D	Dual Directional Coupler 1.9 to 4Gc 20dB	50.00
Hewlett Packard	787D	Directional Detector 1.9 to 4.1Gc	200.00
Hewlett Packard	G910B	Termination 3.95 to 5.85Gc	75.00
Hewlett Packard	X914B	Moving Load 8.2 to 12.4Gc	100.00
Hewlett Packard	2830A	Sensor Oscillator	50.00
Hewlett Packard	3603	Microwave Switch 500mc to 12.4Gc SPST	100.00
Hewlett Packard	0431A	Bandpass Filter 2 to 4Gc	200.00
Hewlett Packard	0436A	Bandpass Filter 8 to 12.4Gc	200.00
Hewlett Packard	9471A	RF Detector	75.00
Hewlett Packard	8472A	Crystal Detector .01 to 18Gc	100.00
Hewlett Packard	8732A	Pin Modulator 1.8 to 4.5Gc 80dB	400.00
Hewlett Packard	8733A	Pin Modulator 3.7 to 8.3Gc 35dB	350.00
Hewlett Packard	10100B	Termination 50 ohms	25.00
Hewlett Packard	10855A	Preamp. 2 to 1300Mc	200.00
Hewlett Packard	11660A	Tracking Generator Shunt	50.00
Hewlett-Packard	11693A	Limiter	300.00
Hewlett Packard	13510	Transistor Test Jig	150.00
Hewlett Packard	33001C	Pin Absorptive Modulator	200.00
Hewlett Packard	33102A	Microwave Switch 100Mc to 18Ghz	100.00
Hewlett Packard	C79-33602A	Microwave Switch DC to 18Gc SPDT	75.00
Hewlett Packard	33038A	Microwave Switch	100.00
Kay	30-D/432D	0 to 101dB Variable Attenuator DC to 1Gc	100.00
Kay	MM781	Noise Source	250.00
Kay	7921A	Noise Source 10 to 900Mc	200.00
Kay	7921A1	Noise Source 10 to 1000Mc	250.00
Loctronic	503A	Tube Mtg./Attenuator and 2X25	50.00
MDL	90LW26-1	X Band Load	50.00
MECA	715-152	Directional Coupler 4 to 8Gc 20db (Narda 3044820)	100.00
Merrimac	AU-26A/	801162 Variable Attenuator	75.00
Microtech	214972	Microwave Switch	50.00
Military	AT-68/UPM	Horn Antenna 8.5 to 9.6Gc	25.00
Military	UG-52B/U	6dB Attenuator	35.00
Narda	70B	Variable Attenuator 0 to 40dB	100.00
Narda	792FM	Variable Attenuator 2 to 2.5Gc 0 to 17dB min. 2.5 to 12.4Gc 0 to 20dB min.	250.00
Narda	2301-20	Directional Coupler 2 to 4Gc 20dB	100.00
Narda	2301-30	Directional Coupler 2 to 4Gc 30dB	100.00
Narda	2366	Variable Directional Coupler 1.2 to 1.4Gc 7 to 12dB	90.00
Narda	2863		
Narda	2864		
Narda	2979	BiDirectional Coupler 4 to 8Gc 20dB	100.00
Narda	3002-10	Directional Coupler .95 to 2Gc 10dB	100.00
Narda	3002-20	Directional Coupler .95 to 2Gc 20dB	100.00
Narda	3003-10	Directional Coupler 2 to 4Gc 10dB	100.00
Narda	3003-30	Directional Coupler 2 to 4Gc 30dB	100.00
Narda	3004-10	Directional Coupler 4 to 10Gc 10dB	100.00

"TEST EQUIPMENT"

TEST EQUIPMENT

Boonton	202J	AM FM Signal Generator 195 to 270MHz	450.00
Boonton	202J/207H	AM FM Signal Generator and Univerter 100KHz to 55Mc and 195 to 270Mc	600.00
CMC	931	Heterodyne Converter 200 to 1200Mc	200.00
Chushman	MCM5	Monitor	750.00
Alfred	8000/7051	Sweep Network Analyzer 100KHz to 40Gc	600.00
Meguro	MSG-2282A	Standard Signal Generator For CB	250.00
Gertsch	FM3	Frequency Meter 20 to 1000Mc	150.00
Systron Donner	1037/1291A	Frequency Meter 0 to 50Mc with Plug In to 500Mc	500.00
Singer	SPA3/25A	Spectrum Analyzer 1Kc to 25Mc and a G-6 Companion Sweep Generator 0 to 15Mc and PS-19 Power Supply	1500.00
Measurements	65B	Standard Signal Generator 75Hz to 35Mc	250.00
Measurements	140	Standard Deviation Meter 25 to 1000Mc	200.00
Polarad	MSG-2	Signal Generator 2150 to 4600Mc	500.00
E.H.	574	Microwave Swept Oscillator 8 to 12.4Gc	750.00
Monsanto	1107	Time Interval Plug In	50.00
Military	TS-1011/	UPM84 Spectrum Analyzer 10Mc to 40Gc with 1Each Filter F335/F336/F337/F338/F341/1Each Attenuator CN411/CN410/CN409 and 1Each Adapter UG1239/UG1240/UG1241/UG1242	1800.00
General Radio	805C	Standard Signal Generator 16Kc to 50Mc	300.00
Hewlett Packard	230A	Power Amplifier 10 to 500Mc 4.5watts	400.00
Hewlett Packard	230B	Power Amplifier 10 to 500Mc 4.5watts	800.00
Hewlett Packard	240A	Sweep Generator 4.5 to 120Mc	400.00
Hewlett Packard	410C	VTVM to 700MHz	400.00
Hewlett Packard	415D	SWR Meter	250.00
Hewlett Packard	431B	Power Meter 10Mc to 40Gc	150.00
Hewlett Packard	606A	Signal Generator 50KHz to 65Mc	800.00
Hewlett Packard	608D	Signal Generator 10 to 420Mc	400.00
Hewlett Packard	608C	Signal Generator 10 to 480Mc	500.00
Hewlett Packard	608E	Signal Generator 10 to 480Mc	1500.00
Hewlett Packard	608F	Signal Generator 10 to 455Mc	1500.00
Hewlett Packard	612A	Signal Generator 450 to 1230Mc	500.00
Hewlett Packard	614A	Signal Generator 900 to 2100Mc	500.00
Hewlett Packard	616A	Signal Generator 1.8 to 4.2Gc	400.00
Hewlett Packard	616B	Signal Generator 1.8 to 4.2Gc	500.00
Hewlett Packard	618A	Signal Generator 3.8 to 7.6Gc	400.00
Hewlett Packard	618B	Signal Generator 3.8 to 7.6Gc	500.00
Hewlett Packard	620A	Signal Generator 7 to 11Gc	400.00
Hewlett Packard	623B	Test Set 5925 to 7750Mc	500.00
Hewlett Packard	626A	Signal Generator 10 to 15Gc	2000.00
Hewlett Packard	628A	Signal Generator 15 to 21Gc	2500.00
Hewlett Packard	940A	Frequency Doubler 26.5 to 40Gc	1000.00
Hewlett Packard	3550A	Portable Test Set	1000.00
Hewlett Packard	5245L	Frequency Counter 0 to 50Mc	1000.00
Hewlett Packard	5251A	Plug In For above 20 to 100Mc	100.00
Hewlett Packard	5252A	Plug In For above 100 to 350Mc	200.00
Hewlett Packard	5253B	Plug In For above 50 to 500Mc	350.00
Hewlett Packard	5254B	Plug In For above 200Mc to 3Gc	750.00
Hewlett Packard	5260A	Frequency Divider to 12.4Gc For above	1000.00
Hewlett Packard	5262A	Plug In For above Time Interval	100.00
Hewlett Packard	5327B	DVM and Frequency Meter to 550Mc	1500.00
Hewlett Packard	DY5636	H Band Generator/Test Set 7.1 to 8.5Gc	1000.00
Tektronix	491	Spectrum Analyzer Solid State 10Mc to 40Gc.	7000.00
Micro Tel	MSR903	Microwave Receiver to 40Gc Digital Readout	9000.00
Tektronix	190B	Signal Generator 350KHz to 50Mc	150.00
Telonic	2003	Sweep/Signal Generator Systems 3305 5 to 1500Mc Autoplex,2/3323 1 to 2000Mc Variable Marker,3340 RF/Output Attenuator 50 ohms,3350 RF Detector,3360A Rate Modulation,3370Display Processing.	1000.00
Telonic	2003	Sweep/Signal Generator Systems 3303 5 to 500Mc Sweep,3323 1 to 2000Mc Variable Marker,3343 RF/Output 50 ohms,3340 RF Output/Attenuator 50 ohms,3350 RF Detector,3360A Rate Modulation,3370 Display Processing.	750.00

MICROWAVE COMPONENTS

Narda	3004-20	Directional Coupler 4 to 10Gc 20dB	100.00
Narda	3032	Hybrid .95 to 2Gc 3dB	150.00
Narda	3033	Hybrid 2 to 4Gc 3dB	150.00
Narda	3039-20	Directional Coupler 125 to 250Mc 20dB	150.00
Narda	3040-20	Directional Coupler 240 to 500Mc 20dB	125.00
Narda	3043-20	Directional Coupler 2 to 4Gc 20dB	100.00
Narda	3044-20	Directional Coupler 4 to 8Gc 20dB	100.00
Narda	3044B20	Directional Coupler 3.7 to 8.3Gc 20dB	150.00
Narda	3045C30	Directional Coupler 7 to 12.4Gc 30dB	125.00
Narda	4035	Hybrid 3dB	150.00
Narda	22006/	3043-20 Directional Coupler 1.7 to 4Gc 20dB	100.00
Narda	22007/	3043-30 Directional Coupler 1.7 to 4Gc 30dB	100.00
Narda	22011/	3003-10 Directional Coupler 2 to 4Gc 10dB	100.00
Narda	22012/	3003-30 Directional Coupler 2 to 4Gc 30dB	100.00
Narda	22377	Adapter X to N 8.2 to 12.4Gc	35.00
Narda	22538/	4014-10 Directional Coupler 3.85 to 8Gc 10dB	75.00
Narda	22539/	4015C10 Directional Coupler 7.4 to 12Gc 10dB	85.00
Narda	22540A/	4013C10 Directional Coupler 2 to 4Gc 10dB	75.00
Narda	22574	Directional Coupler 2 to 4Gc 10dB	100.00
Narda	22689	Directional Coupler 15.8 to 17.3Gc	125.00
Narda	22876/	4014C6 Directional Coupler 3.85 to 8Gc 6dB	100.00
Narda	23105/	4015C30 Directional Coupler 7 to 12.4Gc 30dB	100.00
Norsal	14064-30	Directional Coupler 6 to 10Gc 30dB	75.00
PRD	C1D1	Variable Attenuator 5.85 to 8.2Gc 0 to 60dB	350.00
PRD	U1D1	Variable Attenuator 12.4 to 18Gc 0 to 60dB	300.00
PRD	205A	Slotted Line with Probe 4 to 10Gc	100.00
PRD	585A	Frequency Meter 8.2 to 10Gc	125.00
PRD	K3414	90° Twist 18 to 26.5Gc	90.00
PRD	5815	Wavemeter 7 to 10.6Gc	75.00
PRD	N6001	Crystal Switch	50.00
PRD	X6284	Thermistor Mount 8.2 to 12.4Gc	125.00
Quantatron	5100	Bodystub Tuner	50.00
RLC	A-2610C	Variable Attenuator	50.00
Radar Design	D1536	Directional Coupler	75.00
Sage	752-3	Coupler	25.00
Sage	2503	Mixer	25.00
Sage	7753-3	Directional Coupler 4 to 6Gc 3dB	50.00
Sperry Microline	1261	Frequency Meter 5.64 to 8.2Gc	200.00
Staddart	90515	10dB Attenuator	35.00
Systron Donner	DBE319A	Tunable Detector 18 to 26.5Gc	200.00
Tektronix	S1	Sampling Head	Call
Tektronix	S2	Sampling Head	Call
Tektronix	S50	Pulse Generator Head	Call
Tektronix	B170A	170 ohm Variable Attenuator	50.00
Telonic	TBP417-34-5CD2	Bandpass Filter	15.00
Texscan	SWF250-500-1AA	Tunable Bandpass Filter 250 to 500Mc	250.00
Transco	919C70100	SPDT Switch	25.00
Waveline	601	Adapter X to TNC 8.2 to 12.4Gc	35.00
Waveline	9009-10	Directional Coupler 4 to 10Gc 10dB	100.00
Wavetek	5070	0 to 70dB Variable Attenuator	75.00
Weinschel Eng.	2692	+30 to 60dB Vairable Attenuator	50.00

Microwave Equipment

Manufacture	Model	Description	Price
PRD	219/3302/ 3302L/1106A	20 to 1000MHz Standing Wave Detector and Matched Load	$250.00
Hewlett Packard	805A	Slotted Line 500MHz to 4GHz	200.00
Hewlett Packard	809C	Slotted Line 500MHz to 4GHz	400.00
Hewlett Packard	809B with	8068 Slotted Line 3 to 12GHz/G810B Slotted Line 3.95 to 5.85GHz/J810B Slotted Line 5.85 to 8.2GHz/X810B Slotted Line 8.2 to 12.4GHz/P810B Slotted Line 12.4 to 18GHz/ X281A & H281A Adapter/HX292B Tapered Transition/444A Probe 2.6 to 18GHz/and a 447B Probe/M810B Slotted Line 7.05 to 10.5	900.00
Hewlett Packard	809B with	8068 Slotted Line 3 to 12GHz/H810B Slotted Line 7.05 to 10.5GHz/X810B Slotted Line 8.2 to 12.4GHz/HX292B Tapered Transition H to X/H281A & X281A/with Probe.	550.00

MHz electronics

(602) 242-8916

2111 W. Camelback

Phoenix, Arizona 85015

Toll Free Number
800-528-0180
(For orders only)

✓48

✓See List of Advertisers on page 114

FULL LINE ALL PARTS & COMPUTER PRODUCTS

Quest ELECTRONICS

P.O. Box 4430M
Santa Clara, CA 95054
Will calls: 2322 Walsh Ave.
(408) 988-1640

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

INTEGRATED CIRCUITS

Phone orders only (800) 538-8196

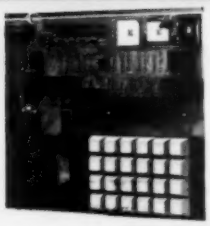
7400TTL		LM317T	1.65	CD4017	1.05	8T26	1.69	UART/FIFO		DE9S	1.59
7400N	10	LM317K	2.75	CD4018	.94	8T28	1.95	AY5-1013	1.50	DE15P	2.10
7402N	10	LM318	1.40	CD4019	.49	8T97	.99	AY5-1014	1.50	DA15S	2.10
7404N	10	LM320K-5	1.35	CD4020	.95	8T98	1.65	3341	6.00	Complete Set	9.00
7408N	10	LM320K-12	1.35	CD4021	.95						
7410N	10	LM320K-15	1.35	CD4022	1.10			Dispatch Kit	79.95		
7414N	69	LM320T-5	.99	CD4023	.29	MOS MEMORY RAM		Audio Clock Kit	17.95		
7420N	10	LM320T-12	.99	CD4024	.75	2101-1	1.95	Digital Clock Kit	19.75		
7427N	10	LM320T-15	.99	CD4025	.23	2102-1	.79				
7440N	49	LM337T	1.65	CD4026	1.65	2102AL-4	1.45	RESISTORS 1/4 watt 5%			
7442N	69	LM323K-5	4.95	CD4027	.65	2102AL-2L	1.65	10 per type	.03		
7447N	69	LM340T	.65	CD4028	.85	2114AL-4	1.65	25 per type	.025		
7448N	69	LM309K	.99	CD4029	.95	21H09-4	3.75	100 per type	.015		
7450N	10	LM340K-5	1.35	CD4030	.65	2111-1	2.49	1000 per type	.012		
7473N	49	LM340K-8	1.35	CD4035	.95	8741A	39.95	300 piece pack			
7486N	69	LM340K-12	1.35	CD4042	.65	8748	29.95	5 per type	0.75		
7490N	11.75	LM340K-15	1.35	CD4043	.75	8748-8	59.00	¼ watt 5% per type	.05		
7493N	39	LM340K-24	1.35	CD4044	.65	8755A	49.00				
74107N	39	LM340T-5	.65	CD4046	.85	4116 200ns	2.50	DIP SWITCHES			
74109N	1.69	LM340T-8	.65	CD4046	.95	4116 200ns	15.40	MB25123	2.95	4-position	.69
74107N	39	LM340T-12	.69	CD4047	.65	MM5280	3.49	MB25125	3.75	5-position	.69
74121N	39	LM340T-15	.69	CD4048	.75	MM5290	3.49	MB25129	4.75	6-position	.69
74123N	49	LM340T-18	.69	CD4049	.49	MM5320	9.75	MB25131	4.95	8-position	.69
74125N	45	LM340T-18	.69	CD4050	.49	MM5330	5.94	MB25133	4.95		
74126N	49	LM340T-24	.69	CD4051	.65	P5101L	10.69	MB25137	9.75		
74138N	1.39	LM309	5.00	CD4066	.71	4200	11.50			KEYBOARDS	
74150N	69	LM337	2.29	CD4068	.29	9300	3.00	0223	3.00	58 key ASCII keyboard kit	$74.95
74154N	1.25	LM380N	1.49	CD4069	.29	4100	10.69			Fully assembled	84.50
74157N	69	LM391	1.69	CD4070	.55	410	2.50	CONNECTORS		Enclosure Plastic	19.95
74161N	69	LM380	1.49	CD4071	.55			36 pin edge	2.00	Metal Enclosure	59.95
74162N	69	LM7805K	.69	CD4072	.39			44 pin edge	2.75		
74163N	69	LM723H/N	.49	CD4073	.39	CLOCKS		50 pin edge	4.00	LEDS	
74174N	69	LM7812K	.69	CD4075	.39	MM5311	4.95	100 pin edge w/w	4.95	Red T1¾	.10
74175N	85	LM741CH	35	CD4076	.95	MM5312	3.95			Green, Yellow T1¾	.20
74181N	3.95	LM741N	.35	CD4078	.39	MM5314	3.50			Jumbo Red	.20
74192N	75	LM747H/N	.75	CD4081	.39	MM5369	1.49	IC SOCKETS		Green, Orange, Yellow Jumbo	.25
74193N	79	LM748N	.35	CD4082	.39	MM5840	14.40	Solder Tail Low Profile		Clip-On LED Mounting Clips 5/$1	.25
74194N	1.75	LM1458	1.75	CD4085	.39	MM5865	7.95	14pin .70 .75		(spec. red, amber, green, yellow, clear)	
74209N	69	LM1304	1.10	CD4089	5.50	CT7555	0.95	8 .13 .22 .39			
74365N	69	LM1307	1.27	CD4097	.95	MM5375AA/N	3.99	14 .14 .24 .40		CONTINENTAL SPECIALTIES in stock	
74366N	69	LM1307	1.10	CD4097	1.95	MM5375AS/N	3.99	16 .16 .26 .45		Complete line of breadboard test equip.	
74367N	69	LM1310	2.75	CD4510	.89	7208	16.50	18 .18 .28 .50			
		LM1496	.99	CD4511	.99	7209	9.00	20 .20 .30 .55		OK WIRE WRAP TOOLS in stock	
74LS00 TTL		LM1812	9.25	CD4515	2.35	7299	15.95	24 .24 .32 .60		Complete line of AP Products in stock.	
74LS00N	25	LM1889	2.49	CD4516	1.10	7299	19.95				
74LS04N	33	LM2111	1.75	CD4518	.89			WIRE WRAP LEVEL 3		SPECIAL PRODUCTS	
74LS08N	33	LM2900	2.25	CD4520	1.10	MICROPROCESSOR		Pins Pins		2.5 MHz Freq. Counter Kit	37.95
74LS10N	33	LM3900N	.69	CD4527	1.10	6502	5.95	14 .55 .24 .02		30 MHz Freq. Counter Kit	47.75
74LS20N	33	LM3900	1.29	CD4528	.89	6800	9.95	16 .67 .28 1.00			
74LS27N	33	LM3909	1.29	CD4553	3.25	6809	9.95	18 .67 .40 1.50			
74LS30N	33	LM3911	1.75	CD4555	.59	6800	8.95	2 level 14 pin only .20		AC TRANSFORMERS	
74LS32N	33	LM3914N	3.49	CD4556	.59	6502	8.95			FRAME	WALL PLUG
74LS74N	45	MC1458P	1.00	CD4585	.89	6802	8.95			9.2V CT 600 ma $4.50	10V 2 amp $7.95
74LS86N	45			CD4066	.89	6820	8.95			12V 250 ma 1.95	12V 250 ma 2.95
74LS109N	45	NE555N	.39	CD4093	2.20	6821	11.69	CRYSTALS		12.6V CT 600 ma 4.95	12V CT 250 ma 3.75
74LS123N	75	NE556A	.85	CD4510	3.00	6840	11.69	1 MHz	4.00	12.6V CT 2 amps 5.95	12V CT 500 ma 4.50
74LS138N	75	NE558N	1.75			6843	14.95	2 MHz	4.00	12.6V CT 4 amps 8.50	12V 1 amp 5.95
74LS139N	75	NE566N	1.59	74C00	.35	6845	11.95	3 MHz	4.25	12.6V CT 6 amps 10.50	12V 2 amp 7.95
74LS151N	75	NE567N	1.69	74C10	.35	6850	4.50	4 MHz	4.25	24V CT 100 ma 3.95	
74LS153N	75	NE570N	4.75	74C20	.35	6852	4.50	5 MHz	3.00	24V CT 500 ma 4.95	
74LS157N	75	NE571N	4.75	74C30	.35	6860A	3.95	6 MHz	3.00		
74LS174N	95	ICL7103	9.50	74C42	.95	6862	8.95	10 MHz	3.00	Constant Voltage Transformers 12V, 11 amp; 5V, 23 amp; 24V, 11 amp	15.00
74LS190N	1.00	ICL7107	14.25	74C73	.55	6875	8.95	12 MHz	3.00		
74LS221N	1.15			74C83	1.10	6880	8.95	16 MHz	3.00		
74LS258N	69	CMOS		74C85	1.10	6885	8.95	18 MHz	3.00	DISPLAY LEDS	
74LS367N	69	CD4000	.25	74C86	.55	6886	8.95	20 MHz	3.00	MAN3274	CA CA .300 .75
		CD4001	.25			6887	8.95	24 MHz	3.00	DL704	CC .300 1.25
LINEAR		CD4002	.25	MISCELLANEOUS		6888	8.95	32 MHz	3.00	DL707	CA .300 1.00
CA3045	.90	CD4006	.95	8223	.65	6890	8.95			DL707-DL707R	CA .300 1.00
CA3046	1.10	CD4007	.25	8224	2.50	6892	8.95	Constant Voltage Transformers 12V, 11 amp; 5V, 23 amp; 24V, 11 amp	15.00	DL727 .739	CA CC .560 1.60
CA3081	1.60	CD4008	.95	8226	.65	6895	8.95			DL747 .700	CA CC .600 1.40
CA3083	1.99	CD4009	.45	8228	.99	6896	8.95			FND500 .500	CC CC .300 .75
CA3089	3.40	CD4010	.45	8251	1.75	6899	8.95			FND503-507	CC CA .500 .99
LM301AN/H	.74	CD4011	.25	8253	1.75	6900	8.95			FND510-519	CC CA .600 .90
LM305H	.67	CD4012	.25	8T13	1.75	6901	8.95			FND560-567	CC CA .800 2.20
LM307N	.25	CD4013	.65	8T23	1.75	6902	8.95			10 digit display	1.25
LM308N	.98	CD4014	.65	8T24	1.75	6903	8.95			7520 Clarex photocells	.99
LM309K	1.25	CD4015	.65	8T25	3.30	6904	8.95			TIL311 Hex	8.50
LM311H/N	.64	CD4016	.65	8T26		6810P	5.95			MAN3640	CC .36 .99
										MAN4610	CA .40 .99
										MAN4640	CC .40 1.20
										MAN6610	CA .40 .99
										MAN6740	CC .40 1.20
										MAN6940	CC .60 .99
										MAN8610	CA .60 .99
										MAN8710	CC .60 .99
										MAN8810	CC .60 .99

9 Computers RS232

DB25P	2.95
DB25S	3.69
Cover	1.67

TELEVIDEO TERMINAL
Model 950 $1010.00

4116 200ns Dynamic RAM 8/$15.40



RCA Cosmac 1802 Super Elf Computer $106.95

The Super Elf is a small single board computer that does many **big** things. It's an excellent computer for training and for learning programming with its machine language and yet it's easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for SS-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Moews Video Graphics **$3.50,** Games and Music **$3.00,** Chip 8 Interpreter **$5.50,** Starship 4K cassette **$14.95.**

Free 14 page brochure of complete Super Elf system.

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range $\pm .17E^{38}$), 32 bit integer ± 2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O routines included.

Super Basic on Cassette $55.00.

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf.** The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake.** They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.95, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50.** A **50 pin connector set** with ribbon cable is available at **$18.95** for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply below).

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display ROM monitor;, fully expandable. **$419.00.** 4K version **$449.00.** 4K Assembler **$35.00.** 8K Basic Interpreter **$85.00**

Special small power supply 5V 2A 24V .5A assem. in frame **$59.00.** Molded plastic enclosure to fit both AIM 65 and power supply **$52.50.** AIM 65 1K in cabinet with power supply, switch, fuse, cord assem. **$559.00.** 4K **$579.00. A65 40-5000 AIM 65 40 w/16K RAM and monitor $1295.00.** RAM Board Kit (16K, **$195**) (32K, **$215**). VD640 Video Interface Kit **$119.00.** A&T **$149.00.** Complete AIM 65 in thin briefcase with power supply **$518.00.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$629.00**

AIM 65/KIM/SYM/Super Elf 44 pin expansion board; board with 3 connectors **$22.95.**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80, etc. **Dealers: Send for excellent pricing/margin program.**

ELECTRONIC SYSTEMS KITS

Apple Peripheral Kits

SERIAL I/O INTERFACE 0 to 30,000 baud, D.T.R., Input & output from monitor or basic, or use Apple as intelligent terminal, Bd only (P/N 2) **$14.95,** Kit (P/N 2A) **$51.25,** Assembled (P/N 2C) **$62.95.**

PROTOTYPING BOARD (P/N 7907) **$21.95.**

PARALLEL TRIAC OUTPUT BOARD 8 triacs, each can switch 110V, 6A loads, Bd only (P/N 210) **$19.29,** Kit (P/N 210A) **$119.55.**

OPTO-ISOLATED INPUT BOARD 8 inputs, can be driven from TTL logic, Bd only (P/N 120) **$15.65,** Kit (P/N 120A) **$89.95.**

Interface Kits

SERIAL/PARALLEL INTERFACE Bidirectional, Baud rates from 110 to 19.2K, sw selectable polarity of input and output strobe, 5 to 8 data bits, 1 or 2 stop bits, parity odd or even or none, all characters contain a start bit, +5 & −12V required.Bd only (P/N 101) **$11.95,** Kit (P/N 101A) **$42.89.**

RS-232/TTL INTERFACE Bidirectional, requires ±12V, Kit (P/N 232A) **$9.95.**

RS-232/20mA INTERFACE Bidirectional, 2 passive opto-isolated circuits, Kit (P/N 7901A) **$14.95.**

PROM Eraser

Will erase 25 PROMs in 15 minutes. Ultraviolet, assembled. 25 PROM capacity **$37.50** (with timer **$49.50**). 6 PROM capacity OSHA/UL version **$78.50** (with timer **$108.50**).

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$9.95**

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00.** Tiny Basic **$30.00.**

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. only $17.00. Article in June *Radio Electronics*.

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

Type-N-Talk by Votrax

Text to speech synthesizer with unlimited vocabulary, built-in text to speech algorithm, 70 to 100 bits per second speech synthesizer, RS232C interface **$395.00.**

1802 16K Dynamic RAM Kit $149.00

Expandable to 64K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$25.00.**

S-100 4-slot expansion	**$ 9.95**
Super Monitor VI.I Source Listing	**$15.00**

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

TERMS: $5.00 min. order U.S. Funds. Calif. residents add 6% tax.
$10.00 min. VISA and MasterCard accepted. $1.00 insurance optional.
Shipping: Add 5%; orders under $25.00—10%.

FREE: Send for your copy of our NEW 1981 QUEST CATALOG. Include 88¢ stamp.

ramsey the first name in Counters !

9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

ramsey electronic's, inc.
2575 Baird Rd. Penfield, NY 14526

PHONE ORDERS
CALL 716-586-3950

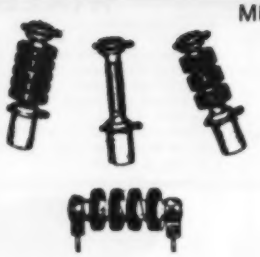
TERMS

See List of Advertisers on page 114

SEMICONDUCTORS SURPLUS

2822 North 32nd Street #1 • Phoenix, Arizona 85008 • Phone 602-956-9423

MINIMUM ORDER $10.00 NOT INCLUDING SHIPPING



CHOKES AND INDUCTORS

4/1.00

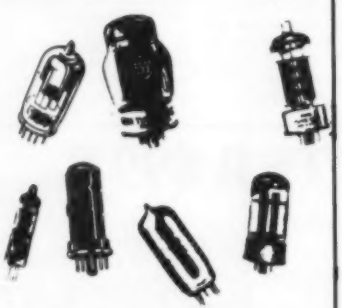
.3 uH	82 uH
.56 uH	91 uH
1.8 uH	180 uH
2 uH	220 uH
3.1 uH	270 uH
6.6 uH	410 uH
52 uH	450 uH
55 uH	

2/1.00

2.4 mH	68 mH
22 mH	

Miller 9055
50-120 uH $2.50

Summita 20K359
455 kc discrimination
Miller #8806/34H-650 $2.50



TUBES

6KD6	$ 5.00
6LQ6/6JE6	6.00
6MJ6/6LQ6/6JE6C	10.00
6LF6/6MH6	6.60
12BY7A	4.00
2E26	4.69
4X150A	29.99
4CX250B	45.00
4CX250R	69.00
4CX300A	109.99
4CX350A/8321	100.00
4CX350F/J/8904	100.00
4CX1500B/8660	300.00
811A	20.00
6360	4.69
6939	30.00
6146	7.95
6146A	9.00
6146B/8298	9.99
6146W	12.95
6550A	10.00
8906	14.00
8950	13.00
4-400A	145.00
4-400C	145.00
572B/T160L	44.00
7289	39.99
3-1000Z	229.00
3-500Z	141.00

CAPACITORS

DIPPED SILVER MICA CAPACITORS

5pF	$.40	120pF	$.25
10pF	.25	150pF	.25
12pF	.30	210pF	.40
15pF	.30	250pF	.40
20pF	.25	330pF	.40
22pF	.25	470pF	.40
24pF	.25	500pF	.40
33pF	.25	560pF	.40
50pF	.25	620pF	.40
75pF	.25	820pF	.50
82pF	.25	6800pF	1.00
100pF	.25		

Quantity pricing also.

ASSORTMENTS

Electrolytic Caps.
All types (new).
50 pcs. $6.99

Capacitors, Resistors & Diodes Assortment
(All New) (Not Junk)
100 pcs. 4.00
250 pcs. 7.00
500 pcs. 12.00
1000 pcs. 20.00

LED Display
FND 357, 362 red
C. C. 2/1.00

TIL312 LED Display
Red 2/1.29

Assorted Heat Sinks—3 each.
For TO-3, TO-220, TO-66 & TO-5.
12/1.99

Assorted Potentiometers
"All new" not junk. Some with switch, some with 1/4" shaft.
#S.S. 283 30 for 4.00
#S.S. 284 100 for 10.00

New Miniature Toggle & Rocker Switch—25 mix. $6.99

New Assorted Toroid Cores
10 big & small 4.00

TO-3 and TO-66 Used Power Transistors
High voltage switching in CRT's.
30 pcs. Good/Bad? $ 2.00
100 pcs. 10.00

Hardware Assortment
1 pound mixed screws, standoffs, washers, feet, insulator 5.00

IC Assortment
50 New IC's. Not Junk.
7400/S/LS Linear, DTL/RTL etc. $10.00

House numbered AY5-2376
Keyboard encoder chip—88 (keys)
same as DR 2376 6.99 each

5 Way DC Voltage Adapter
Selective voltage: 6, 9, and 12VDC.
Input voltage—115VAC $9.99

WALL TYPE TRANSFORMERS
115 VAC input
6 VAC @ 10 MA.....2.99
12 V @ 700 MA.....4.99
15 V @ 300 MA.....3.99
115 VAC & 220 VAC input
15 V @ 300 MA.....3.99

DL-1416
4-Digit 16 Segment Alphanumeric Intelligent Display with Memory, Recorder, Driver $14.95 each

Fuse Holders
HKP type for 3AG .89 each

UHF Varactor Tuners—Sony
19.99 each

Teledyne Serendip
Solid State Dip Relay
Part #A641-1 2.49 each

RCA TRANSISTORS
80684
40235

AMPEREX/MOTOROLA
RF TRANSISTOR
BFR91 .75
MRF901 2.00

RF Transistors

MRF203	P.O.R.
MRF216	31.00
MRF221	10.90
MRF226	12.65
MRF227	3.45
MRF238	12.65
MRF240	15.50
MRF245	34.00
MRF247	34.00
MRF262	9.20
MRF314	20.70
MRF406	13.80
MRF412	25.30
MRF421	36.80
MRF422A	41.40
MRF422	41.40
MRF428	46.00
MRF428A	46.00
MRF426	15.50
MRF426A	15.50
MRF449	12.65
MRF449A	12.65
MRF450	13.80
MRF450A	13.80
MRF452	15.00
MRF453/GE185	17.25
MRF454	19.90
MRF454A	21.83
MRF455	16.00
MRF455A	16.00
MRF458	19.90
MRF472	1.00
MRF474	3.00
MRF475	2.90
MRF476/C1306	2.90
MRF477	11.50
MRF485	3.00
MRF492	23.00
MRF502	1.04
MRF604	2.07
MRF629	3.45
MRF648	33.35
MRF901	2.15
MRF902	8.00
MRF904	3.00
MRF911	3.00
MRF5176	3.00
MRF8004	2.10
BFR90	1.30
BFR91	1.65
BFR96	2.20
BFW92A	1.15
BFW92	1.00
MMCM918	14.30
MMCM2222	15.65
MMCM2369	15.00
MMCM2484	15.25
MMCM3960A	24.30
MWA110	10.00
MWA120	10.00
MWA130	10.00
MWA210	10.00
MWA220	10.00
MWA230	10.00
MWA310	10.00
MWA320	10.00

Transistors

2N2857	1.55
2N2857JAN	2.50
2N2949	3.60
2N2947	15.00
2N2950	4.60
2N3375	8.00
2N3553	1.57
2N3818	5.00
2N3866	1.30
2N3866JAN	2.50
2N3866JANTX	4.00
2N3925	10.00
2N3948	2.00
2N3950	25.00
2N3959	3.85
2N3960JANTX	10.00
2N4072	1.80
2N4427	1.30
2N4429	7.00
2N4877	1.00
2N4959	2.30
2N4976	15.00
2N5070	18.40
2N5071	20.70
2N5108	4.00
2N5109	1.70
2N5179	1.00
2N5583	4.00
2N5589	8.65
2N5590	10.35
2N5591	13.80
2N5635	10.35
2N5636	12.00
2N5637	15.50
2N5641	9.20
2N5643	15.50
2N5645	13.80
2N5842	8.00
2N5849	20.00
2N5942	40.00
2N5946	19.00
2N5862	57.50
2N6080	9.20
2N6081	10.35
2N6082	11.50
2N6083	13.25
2N6084	15.00
2N6095	12.00
2N6096	15.50
2N6097	17.25
2N6166	40.25
2N6368	28.75
A210/MRF517	2.00
BLY38	5.00
40280/2N4427	1.30
40281/2N3920	7.00
40282/2N3927	17.25
MMT74	1.04

IC SALE

400CJ	88
2805HC/1405A	1.00
74LS27	25
P3101/82525/74S289	1.00
SCL4013A/BE	.25
MC14001BCP	.25
MC14017BCP	.75
MC14012BCP	.19
MC14023BCP	.20
MC14027BCP	.39
MC14069BCP	.39
MC14093BCP	.60
MC3420P	1.00
MCM10152L	5.00
MC7408P	.19
74LS05PC	.20
AD580	1.00
8T01B	.60
CH164A	.25
CG388V	.25
74LS20F	.20
748SN	.39
DS0026CH	1.00
CD 4013BCN	.30
CD 4028AE	.49
CD 4040 BCN	.80
CD 4069CN/74C74	.30
MM74C74N	.40
CD 4015CN	.75
DS/DM 8839N	.60
DM 75L51N	.75
TLO-61CP	.30
SN7428N	.25
Z80CPU	4.99
2708-6	1.00
2516/2716	2.50
2732-6	10.00
2102	.50
2114-2 & 3	8/16.00
4104	8/16.00
D2116/4116	8/18.00
D8257	3.00
MC6845	10.00
Z80CTC	4.00
Z80SIO/O or /I	8.00
Z80PIO	4.00
74LS273	.80
74LS373	.80
74LS374	.80
74LS245	1.40
74LS367	.40
74LS14	.60
78M05	.39
78L05	.30
78L15	.30
78L08	.30
79L12	.49
LM317T	.1.99
MC7808T/LM340T-8	.49
7805/LM340T-5	.89
7812/LM340T-12	.89
7815/LM340T-15	.89
7824/LM340T-24	.89
D8202	20.00
D8212	1.00
D8214	2.00
8251	3.00
TMS1000NL	2.00
MC1306P	.75
MC1414L	.29
LM/SN1458V	.40
LM555V	.30
LM309K/7805CK	1.00
MC6852P	3.00
RC74LS51N	.15
SN74LS74N	.20
PT 1482B	2.00
EC 1422B	2.00
LA 4220 Sanyo	1.00
SN75427N	.30
N8T28N/MC6889	1.00
D3232/MC3232	1.00

ORDERING INSTRUCTIONS

Check, money order, or credit cards welcome. (Master Charge and VISA only.) No personal checks or certified personal checks for foreign countries accepted. Money order or cashiers check in U.S. funds only. Letters of credit are not acceptable. C.O.D.—$2.25 + $2.35 shipping.

Minimum shipping by UPS is $2.35 + .35 per $100.00 for insurance. Please allow extra shipping charges for heavy or long items.

All parts returned due to customer error or decision will be subject to a 15% restock charge. If we are out of an item ordered, we will try to replace it with an equal or better part unless you specify not to, or we will back order the item, or refund your money.

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. Prices supersede all previously published. Some items offered are limited to small quantities and are subject to prior sale.

We now have a toll free number, but we ask that it be used for *charge orders only*. If you have any questions, please use our other number. We are open from 8:00 am–5:00 p.m. Monday thru Saturday.

Our toll free number for *charge orders only* is 800-528-3611.

64

MINIMUM ORDER $10.00 NOT INCLUDING SHIPPING

SEMICONDUCTORS SURPLUS

2822 North 32nd Street #1 • Phoenix, Arizona 85008 • Phone 602-956-9423

See List of Advertisers on page 114

COMMUNICATIONS CENTER

CALL TOLL FREE

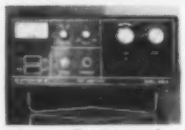
1-800-228-4097

DenTron IS BACK!

E.T.O. ● KENWOOD ● YAESU ● ICOM ● DRAKE ● DENTRON ● HY-GAIN ● APPLE ● SONY ● PANASONIC ● TEMPO ● MIRAGE

HUSTLER ● TELEX ● CUSHCRAFT ● DAIWA ● BENCHER ● TRAC ● J.I.L. ● C.D.E. ● KANTRONICS ● AVANTI ● CENTURION

Dentron Clipperton V



- Big power on 2 meters!
- Self-contained A.C. power supply
- 500 watts from 4-CX-250 B final

CALL FOR SUPER SPECIAL!

Panasonic RF-3100

- AC/battery FM/MW/SW radio
- 31 band operation
- All quartz synthesized tuning
- 5 digit frequency readout
- Limited 2 year warranty

NAV 369.95 **CALL NOW!** **$299.95**

Dentron RT-3000

- 3Kw capability
- Roller inductor
- Power/VSWR meter
- Bypass capability

CALL FOR SPECIAL DISCOUNT!

KENWOOD DM81 Dip Meter

- Frequency range 700 kHz-250 MHZ (7 band)
- Function — inductive coupling capacitive coupling
- Compact size

CALL NOW FOR PRICE!

"Our Most Popular Scanner the JIL SX-100"

*NAV $399.00

16 Channels. 30-54 MHz; 140-180 MHz; 410-514 MHz. Digital Clock. Date Display. 110 V. AC or 12-16 V. DC.
Seek Rate: Fast 10ch/sec
Slow 5ch/sec
Bright Green 9 Digit Frequency Display. Ext. Antenna Jack. Ext. Speaker Jack. Large Top Mounting Bracket. Scan Rate: Fast 8ch/sec. Slow 4ch/sec
Scan Delay Time Variable 0-4 sec.

UNBELIEVABLY PRICED AT A LOW $199.95

KENWOOD HC-10 Digital Clock

Attractive, functional layout, with switch buttons on slanted panel. Cabinet is trigonal prism shaped for stability. With a pleasing color combination and modern styling, the HC-10 will enhance the appearance of any ham shack.

CALL NOW FOR PRICE!

Call for Discount Prices.

Computer

AMDEK
APPLE
ATARI
BASE 2
CENTRONICS
COMMODORE
DC HAYES
HAZELTINE
LEEDEX
MACROTRONICS
MAXELL
MICROSOFT
MOUNTAIN HARDWARE
N E C
NORTHSTAR
PANASONIC
SANYO
SYNCOM

Amateur Radio

AVANTI
BASH BOOKS
BEARCAT
BENCHER
CALL BOOK
CUSHCRAFT
DAIWA
DENTRON
DRAKE
ETO
HUSTLER
HY-GAIN
ICOM
KANTRONICS
KENWOOD
MIRAGE
PANASONIC
SHURE
TEMPO
TELEX
TRAC
YAESU

PRICES SUBJECT TO CHANGE AND AVAILABILITY **YOUR** WE TRADE WE EXPORT

ELECTRONICS CENTER

1840 "O" Street Lincoln, Nebraska 68508
In Nebraska Call (402) 476-7331 ✓28

*Nationally Advertised Value

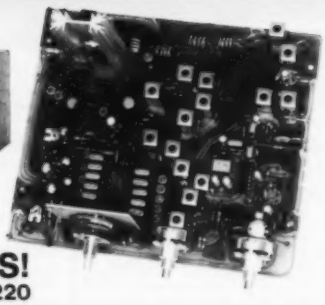
master charge

VISA

• FM • SSB • CW • ATV • OSCAR
• LINKS • REPEATERS • TRANSMITTERS
• RECEIVERS • PREAMPS • CONVERTERS
• TRANSCEIVERS • POWER SUPPLIES • PA'S

QUALITY VHF/UHF KITS AT AFFORDABLE PRICES

-NEW-



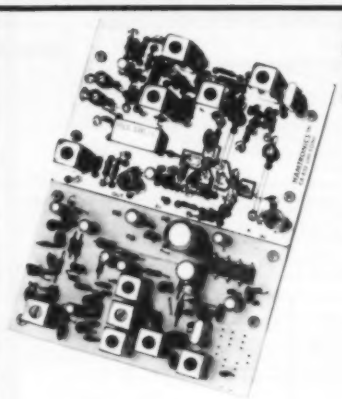
FM-5 PC Board Kit – ONLY $159.95
complete with controls, heatsink, etc.

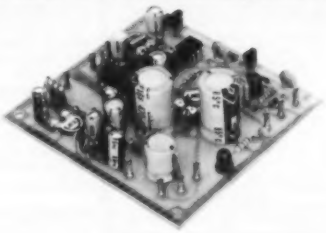
★ **SPECIAL** Free cabinet kit, complete with speaker, knobs, connectors, hardware. A $59.95 value, yours free with purchase of kit Hurry! Offer limited. ★

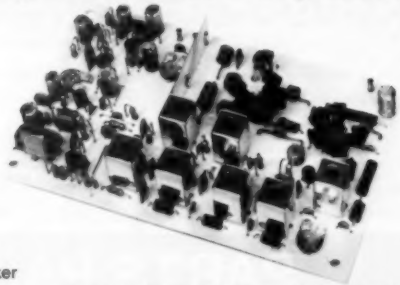
SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

10 watts, 5 Channels, for 6M, 2M, or 220

HIGH QUALITY FM MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.







- **R75 VHF FM RECEIVER** for 10M, 6M, 2M, 220, or commercial bands. 4 fantastic selectivity options. Kits from $84.95 to $119.95
- **R450 UHF FM RECEIVER** for 380-520 MHz bands. Kits in selectivity options from $94.95
- **R110 VHF AM RECEIVER** Kit for vhf aircraft band or ham bands. Only $84.95.
- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
- **CWID KITS** 158 bits, field programmable, clean audio. Only $59.95.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.
- **SCANNER CONVERTERS** Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.
- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $54.95.
- **T451 UHF FM EXCITER** for 450 ham band or adjacent. Kits only $64.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

VHF & UHF TRANSMITTING CONVERTERS

For SSB, CW, ATV, FM, etc. Available for 6M, 2M, 220, 440 with many IF input ranges. Converter board kit only at $79.95 (VHF) or $99.95 (UHF) or kits complete with PA and cabinet as shown.

VHF & UHF RECEIVING CONVERTERS

20 Models cover every practical rf and if range to listen to SSB, FM, ATV, etc. on 6M, 2M, 220, 440, and 110 aircraft band. Even convert weather down to 2M! Kits from $39.95 and wired units.

VHF & UHF RECEIVER PREAMPS. Low noise.

VHF Kits from 27 to 300 MHz. UHF Kits from 300 to 650 MHz. Broadband Kits: 20-650 MHz. Prices start at $14.95 (VHF) and $18.95 (UHF). All preamps and converters have noise figure 2dB or less.

- **Call or Write for FREE CATALOG**
  (Send $2.00 or 5 IRC's for overseas MAILING)
- Order by phone or mail • Add $2 S & H per order
  (Electronic answering service evenings & weekends)
  Use VISA, MASTERCARD, Check, or UPS COD.

hamtronics, inc.
65-Q MOUL RD. • HILTON NY 14468
Phone: 716-392-9430

Hamtronics® is a registered trademark

RAMSEY ELECTRONIC'S Inc.

PARTS WAREHOUSE

We now have available a bunch of goodies too good to bypass. Items are limited so order today

2575 Baird Rd.
Penfield, NY 14526
716-586-3950

Call Your Phone Order in Today

TERMS: Satisfaction guaranteed or money refunded. C.O.D. add $2.00. Minimum order $6.00. Orders under $10.00 add $1.50. Add 5% for postage, insurance, handling. Overseas add 15%. N.Y. residents add 7% tax.

MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit **$14.95**
FM-3 Wired and Tested **19.95**

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1 **$8.95**

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 **$2.95**

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker. Complete kit, BN-9 **$5.95**

CPO-1

Runs on 3-12 Vdc 1 watt out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **$2.95**

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit **$3.95** FM-2 kit **$4.95**

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.

Complete kit, WL-1 **$6.95**

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 **$5.95**

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit **$5.95**

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC

MB-1 Kit **$4.95**

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.

Complete kit, SM-3 **$2.95**

60 Hz Time Base

Runs on 5-15 VDC. Low current (2.5ma) 1 min/month accuracy. TB-7 Kit **$5.50**
TB-7 Assy **$9.95**

CLOCK KITS

Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5 **$24.95**
Clock with 10 min. ID timer, 12/24 hour, DC-10 **$29.95**
Alarm clock, 12 hour only, DC-8 **$29.95**
12V DC car clock, DC-7 **$29.95**

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

Car Clock

The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled — you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell — assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format **$22.95**
DC-3 wired and tested **$29.95**

Calendar Alarm Clock

The clock that's got it all: 6- 5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size: 5x4x2 inches. Complete kit, less case (not available)

DC-9 **$34.95**

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer atuomatically adjusts display to ambient light level.

DC-11 clock with mtg. bracket **$27.95 kit**
DM-1 dimmer adapter **$3.50**
Add $10.00 Assy. and Test

Video Terminal

A completely self-contained stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 6416 is 64 char. by 16 lines with scrolling, upper and lower case (optional) and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 6416, terminal card kit (add $80.00 for wired unit) **$189.95**
Lower Case option **$13.95**
Power Supply **$14.95**
RF Modulator kit **$7.95**

PARTS PARADE

IC SPECIALS

LINEAR

301	$ .35
324	$1.80
380	$1.90
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .50
3914	$2.95
8038	$2.95

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

FERRITE BEADS

With info and specs 15/$1.00
6 Hole Balun Beads 8/$1.00

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7891 .43" C.A.	2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
2N4916 FET C+F	4/$1.00
2N5401 PNP C+F	5/$1.00
2N6026 C+F	4/$1.00
2N3771 NPN Silicon	$1.00
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/$1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	$.60
2N3845 UJT	3/$2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge **$1.50 each**

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center. ½" leads, bag of 300 or more.

$1.50

Switches

Mini toggle SPDT **$1.00**
Red Pushbuttons N.O. **3/$1.00**

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc.

5 for $1.00

Mini 8 ohm Speaker

Approx. 2¼" diam. Round type for radios, mike etc.

3 for $2.00

Solid State Buzzers

small buzzer .450 Hz, 86 dB, sound output on 5-12 vdc at 10-30 mA, TTL compatible **$1.50**

Slug Tuned Coils

Small 3/16" Hex Slugs turned coil. 3 turns. 10 for $1.00

AC Outlet

Panel Mount with Leads **4/$1.00**

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic	DISK CERAMIC
1.5 uF 25V 3/$1.00	1000 uF 16V Radial $.50	.01 16V disk 20/$1.00
1.8 uF 25V 3/$1.00	500 uF 20V Axial $.50	1 16V 15/$1.00
.22 uF 25V 3/$1.00	150 uF 16V Axial 5/$1.00	.001 16V 20/$1.00
	10 uF 15V Radial 10/$1.00	100 pF 20/$1.00
		.047 16V 20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **$1.25**

Ceramic IF Filters

Mini ceramic filters 7 kHz B.W. 455 kHz $1.50 ea.

25K 20 Turn Trim Pot **$1.00**
1K 20 Turn Trim Pot **$.50**

Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene .50 ea.

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Mini RG-174 Coax

10 ft. for $1.00

Coax Connector

Chassis mount BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips 5 for $1.00
¾" Rubber Grommets 10 for $1.00

Parts Bag

Asst. of chokes, disc caps, tant. resistors, transistors, diodes, MICA caps etc. em. bag (100 pc) $1.00 lg. bag (300 pc) $2.00

Connectors

6 pin type gold contacts for mA-1003 car clock module price .75 ea.

Leds - your choice, please specify
Mini Red, Jumbo Red, High Intensity Red, Illuminator Red **8/$1**
Mini Yellow, Jumbo Yellow, Jumbo Green **6/$1**

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - .50 each or 3/$1.00

Crystals

3.579545 MHZ	$1.50
10.00000 MHZ	$5.00
5.248800 MHZ	$5.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end.

8.5 vdc @ 20 mA	$1.00
16 vdc @ 160mA	$2.50
12 vac @ 250mA	$3.00

Audio Prescaler

Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity, specify -10 or -100

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit **$6.95**

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V @ 1 A and 24 VCT.

Complete kit, PS-3LT **$6.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.

50 for only $9.00 **10 for $2.00**

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size: 1" x ¼" shrink to ¼". Great for splices. 50/$1.00

Mini TO-92 Heat Sinks

Thermalloy Brand 5 for $1.00
To-220 Heat Sinks 3 for $1.00

Opto Isolators - 4N28 type **$.50 ea.**
Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. 20 strips for $1.00

CDS Photocells

Resistance varies with light, 250 ohms to over 3 meg 3 for $1.00

DIGITAL RESEARCH: PARTS

"TOP QUALITY PARTS FOR LESS"

M.O.H.O. It never fails: Someone calls you on the telephone and you need to change phones to get some information. You put the phone down, go to another phone and give them the information, then hang up. Oops! You forgot to hang up the phone you first answered! No more phone calls for you until you discover your mistake!! Or, the phone rings right in the middle of a serious talk with your children, spouse, girl friend, *etc*. You have to lay the phone down, go to another room to finish your conversation, leaving your caller in silence. Or how many times has one of your not-so-good friends asked you and your spouse to go out Friday night and you are sitting there making all these weird gestures and rolling your eyes, etc. Your spouse does not know whether to pour cold water on you or run screaming into the street. Well **NO MORE**. Digital Research is proud to announce the **M.O.H.O.**, the first patented, electronic hold control for your home telephone. Return to the same phone or any phone in your home and your party is still there. All the time your party is on hold, they may listen to A.M., F.M., casette, T.V., or any other device you wish to hook up to **M.O.H.O.** No need to butcher your phone either. Only two wires to connect to your existing phones. One wire to tip and the other wire to ring. For those not too *telephoneically* inclined — one to the red wire and one to the green wire. The **M.O.H.O.** reisdes in an attractive box approximately 6" x 4" x 2", which may be placed anywhere. Now comes the fun part. You have just received **M.O.H.O.** (kit form takes about 1½ hours to complete). There are only two things to do: hook the red and green wire to the telephone and plug **M.O.H.O.** into A.C. outlet. Remember **M.O.H.O.** is completely legal, patented and F.C.C. approved. (We provide you with a Registration Sticker too.)

Assembled and Tested **$37.50**

Kit $29.95 Complete

(For rotary dial add $1.50 per phone)

POWER SUPPLY TRIPLE OUTPUT

25 Volts @ .18A
5 Volts @ .8A
15 Volts @ 1.25A
Isolated independent outputs
Positive or negative operation
Constant Voltage Regulation
25 Volt line adjustable with 10 turn pot from 23.5 V to 28 Volts. 120 Volt - 60 Hz input Fused - H=3¾" W=5½" D=4"

$14.95

Precision Hybrid Oscillator Module

Has both 1 MHZ and 2 MHZ TTL - outputs —Hermetically sealed —Ultra high stability over wide temp. range —originally cost over $40.00 each — we made a super purchase from a major computer manufacturer — 5 Volt operation - fits standard 24 pin socket - Manufactured by Motorola oscillator division.

MC6871A

3/20.00

7.50 w/data

NEO 2137 by NEC

- Microwave R.F. transistor (N.P.N.)
- Micromold Package #37
- Dual Emitter leads
- FT to 4.5 GHZ
- VCEO 10V-CC 20 MA. HFE 40-200
- Gain 10V-20MA-1GHZ = 14DB Typical
- Very low noise - High gain 1.5 DB @500 MHZ
- Cleared for high reliability space applications

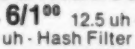
COMPARE **1.50**

REGULATORS

LM309K +5 v. 1.5 amp TO-3	1.00
LM120K -5 v. 1.5 amp TO-3	1.00
7805 +5 v. 1 amp TO220	1.00
7812 +5 v. 1 amp TO220	1.00
7905 -5 v. 1 amp TO220	1.00
7912 -12 v. 1 amp TO220	1.00

Fixed Inductors

.39 uh - **6/1.00** 12.5 uh - **8/1.00**
500 uh - Hash Filter @ 2 Amps - **4/1.00**



Molded Choke

13 uh - **8/1.00** 50 mh - **6/1.00**
1.2 mh - **8/1.00**

Variable Inductors

30-40 uh
.9 uh - 1.2 uh
11 uh to 20 uh
.25 uh - .35 uh
.85 uh - .95 uh

4/1.00

EIAJ #1SS98

NEC #4981-7E
Microwave - Schottky barrier diode

HP-Hot Carrier diodes
5082-2835

99¢ or 6/5.00

UNIVERSAL TIMER KIT

★ **Adjustable from 1 sec to 1 hr.**
★ **Control up to 1 amp**
"Turn Things On Or Off"

Kit includes all parts necessary to build this exciting kit. Uses: Children's T.V. programs - Darkroom exposures - Amateur 10 min. I.D.er - Egg Timer - Intermittent Windshield Wiper. Absolutely endless uses. Complete kit including power supply, p.c. board DPDT relay, and all parts to make timer operational.

$8.95

ORDER YOUR FREE 1982 CATALOG TODAY!

Digital Research: Parts

P.O. Box 401247 • Garland, Texas 75040

(214) 271-2461

TERMS
Add 1 postage we pay balance. Orders under $15 add 75¢ handling. No C.O.D. We accept Visa, MasterCard and American Express cards. Tex. Res. add 5% Tax. Foreign orders (Canada 10%) add 20% P & H.

• VISA • MASTERCARD • AMERICAN EXPRESS •

SPECIALISTS · CUSHCRAFT · DRAKE · HAM KEY · HUSTLER · HY-GAIN · ICOM · KANTRONICS · LARSEN · MFJ · MORGAIN · PANASONIC · RAMSEY · SHURE · SONY · TELEX · TEN TEC · TRAC · TRANSCOM · VAN GORDON · VOCOM · ANTENNA SPECIALISTS · AVANTI · ARRL PUBS · AMECO · BASH · BEARCAT · BENCHER · B&W · BIRD · CALLBOOK · COMMUNICATIONS

SONY ICF2001

DIGITAL
DIRECT ACCESS
SHORT WAVE RECEIVER

- 150KHz -30 MHz + FM BROADCAST
- PLL SYNTHESIZED WITH SCANNING & MEMORY
- AC ADAPTOR INCLUDED
- 1 YEAR SONY U.S.A. FACTORY LIMITED WARRANTY
- AM/CW/SSB
- SURPRISINGLY AFFORDABLE

CALL AND ORDER YOURS TODAY

OUR BEST-SELLING MULTI-BAND!

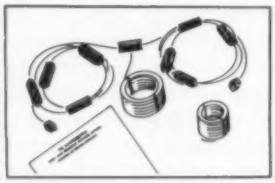
MORGAIN

AS LOW AS
$94.50

Add $5.00
for shipping
(Cont'l U.S.A.)

- One half the length of conventional half-wave dipoles
- Multi-band, Multi-frequency.
- Maximum efficiency — no traps, loading coils, or stubs.
- Fully assembled and pre-tuned — no measuring, no cutting.
- All weather rated — 1 KW AM, 2.5 KW CW or PEP SSB.
- Proven performance — more than 10,000 have been delivered.
- Permit use of the full capabilities of today's 5-band xcvrs.
- One feedline for operation on all bands.

80-40HD/A 80/40 Mtr bands (69).... **99.00**
75/40HD/A 75/40 Mtr bands (66).... **94.50**
75-10HD/A 75/40/20/15/10 Mtr (66).. **126.95**
80-10HD/A 80/40/20/15/10 Mtr (69).. **132.00**



Eavesdropper

SHORT WAVE BROADCAST RECEIVING ANTENNA

$59.95 plus $3.00 shipping (Cont'l U.S.)

- AUTOMATIC BANDSWITCHING!
- COMPLETELY WEATHERPROOF!
- COMPLETE, NO ASSEMBLY NEEDED!
- 80, 40, 41, 31, 25, 19, 16, 13 & 11M BANDS!

All the world's shortwave broadcast bands are yours with the Eavesdropper All-Band antenna. Individually tuned traps make the Eavesdropper work like seven separate antennas, each tuned to a different international broadcast band. Also covers 11, and 60M bands as well. Its 100 foot, 72 ohm balanced feedline provides an exact match to the antenna on every band. Comes completely assembled, and ready to install with 50 ft. of 450 lb. test nylon rope. Overall length: 42'10". Wire: #14 copper clad steel. Bandswitching: Automatic. Impedance to rcvr: 50-75 ohms balanced.
Only $59.95

AMECO ALL-BAND PREAMP!

Our Most Popular Preamplifier

MODEL PLF-2
$52.95 plus $3.00 shipping

MODEL PLF-2...Improves weak signals as much as image and spurious rejection of most receivers. Direct switching to rec. or preamp. Includes pwr. supp. 117 VAC wired & tested..... **$52.95**
MODEL PLF-2E...240 VAC 50-60 Hz operation..... **$57.95**
MODEL PT-2...For transceiver use. Continuously tunable from 6 to 160 meters. Features dual-gate FET transistor amplifier for improved receiver sensitivity and low noise figure. Requires no transceiver modifications and can handle up to 250W transceiver output, 117 VAC 60 Hz.... **$79.95**
MODEL PT-2E...240 VAC 50-60 Hz operation **$84.95**

TRANSCOM

PROGRAMMABLE SUB AUDIBLE TONE ENCODER FOR ICOM HANDHELDS.

NEW!

$29.95
Plus $2.00 shipping and handling

- ONLY 1.1" X 55" X .2"
- PRESET OUTPUT LEVEL FOR IC2A
- LOW TONE DISTORTION LESS THAN 1% THD
- TONE STABILITY ± .2% Hz FROM -20C TO +70C
- 1 YEAR LIMITED FACTORY WARRANTY
- 5VDC POWERED

ICOM

WE'VE SOLD FM GEAR FOR 14 YEARS & IN OUR OPINION ICOM IS...
"SIMPLY THE BEST"

IC2A, IC2AT
OUR MOST POPULAR HAND HELD & THE BEST VALUE AVAILABLE

- COMPACT
- QUALITY CONSTRUCTION
- VERSATILE
- AFFORDABLE
- WIDE RANGE OF ACCESSORIES AVAILABLE

NEW!
IC3AT (220 MHz)
IC4AT (440 MHz)

IC25A

A LITTLE PACKAGE WITH A LOT OF BIG FEATURES...

- 25W OUTPUT
- MEMORIES
- ENCODING MIC
- SCANNING

CALL FOR PRICE & AVAILABILITY

TO ORDER: CALL OR WRITE. MASTER CARD, VISA, MONEY ORDERS, PERSONAL CHECKS TAKE 3 WEEKS TO CLEAR, ACCEPTED. **INTERNATIONAL ORDERS WELCOME**, PLEASE REQUEST PRO FORMA INVOICE.

HOURS: MON. THRU WED. 9:30-6:00, THURS-FRI. 9:30-8:00, SAT. 9:30-3:00

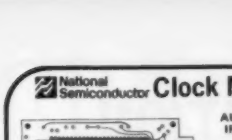
STOP BY AND VISIT WHEN IN THE CHICAGOLAND AREA!!

SPECTRONICS, INC.
1009 GARFIELD ST. OAK PARK, IL. 60304

PHONE
(312) 848-6777

National Semiconductor Clock Modules

12VDC AUTOMOTIVE/ INSTRUMENT CLOCK



APPLICATIONS:
- In-dash autoclocks
- After-market auto/ RV clocks
- Aircraft-marine clks.
- 12VDC oper. instru.
- Portable/battery powered instruments.

Features: Bright 0.3" green display. Internal crystal time-base. ± 0.5 sec./day accur. Auto. display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete – just add switches and lens.

MA1003 Module (3.65"L x 1.75"H x 1.38"D) . **$16.95**

CLOCK MODULES

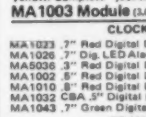
MA1023 .7" Red Digital LED Clock Module	8.95
MA1026 .7" Dig. LED Alarm Clock/Thermometer	18.95
MA5036 .3" Red Digital LED Clock/Timer	8.95
MA1002 .5" Red Digital LED Clock & Xformer	9.95
MA1010 .8" Red Digital LED Clock	7.95
MA1032 CBA .5" Digital LCD Clock	17.95
MA1043 .7" Green Digital LED Clock	8.95

TRANSFORMERS

102-P20 Xformer for MA1023, 1043 & 5036 Mods.	3.49
102-P22 Xformer for MA1026 Clock Modules	3.49
102-P24 Xformer for MA1010 Clock Modules	3.49

NEW!

Sun Power Your Electronics! SOLAR CELL PANEL KIT

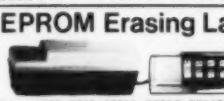


Features:
- Output: 10VDC, to 100mA in Series 5VDC, to 200mA in Parallel
- Panel may be easily connected for Series or Parallel out
- Over 11 square inches of active cell surface
- Voltage line tap @ 0.6V increments
- Provision for charging batteries
- Overall panel size: 4½"L x 4½"H x ½"D

The JE305 Solar Cell Panel Kit contains 20 each solar cells. On the panel board are power line taps which allow the user to select voltages (one voltage at a time) from 0.5VDC to 10VDC. The applications of each panel can be further expanded by coupling additional panels in series for more voltage or in parallel for more current. The premium grade solar cells provide the current necessary for the operation of most portable transistor radios, small battery powered cassette tape players and unlimited experimental solar projects.

JE305 . . . . . **$39.95**

EPROM Erasing Lamp



- Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.
- Erases up to 4 chips within 20 minutes.
- Maintains constant exposure distance of one inch.
- Special conductive foam liner eliminates static build-up.
- Built-in safety lock to prevent UV exposure.
- Compact – only 7-5/8" x 2-7/8" x 2"
- Complete with holding tray for 4 chips.

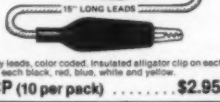
UVS-11EL Replacement Bulb **$16.95**

UVS-11E **$79.95**

JOYSTICKS

JS-5K	5K Linear Taper Pots	$5.25
JS-100K	100K Linear Taper Pots	$4.95
JVC-40	40K (2) Video Controller in case	$4.95

ALLIGATOR CLIP TEST LEADS



Heavy-duty leads, color coded. Insulated alligator clip on each end. 15" long. Two each black, red, blue, white and yellow.

#ALCP (10 per pack) . . . . . **$2.95/pkg.**

NEW!

JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.

FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2" w x 5-1/16" L x 2" H

JE215 Adj. Dual Power Supply Kit (as shown) . . **$24.95**

(Picture not shown but similar in construction to above)

JE200 Reg. Power Supply Kit (5VDC, 1 amp) . .	$14.95
JE205 Adapter Brd. (to JE200) ±5, ±9 & ±12V.	$12.95
JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp.	$19.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

INS8080A	CPU	4.95
DP8212	8-Bit Input/Output	3.75
DP8214	Priority Interrupt Control	5.95
DP8216	Bi-Directional Bus Driver	3.49
DP8224	Clock Generator/Driver	3.75
DP8226	Bus Driver	3.49
DP8228	System Controller/Bus Driver	4.95
DP8212	Input/Output	3.75
INS8243	I/O Expander for 48 Series	9.95
INS8250	Asynchronous Comm. Element	16.95
DP8251	Prog. Comm. I/O (USART)	9.95
DP8253	Prog. Interval Timer	9.95
DP8255	Prog. Peripheral I/O (PPI)	5.95
DP8257	Prog. DMA Control	9.95
DP8259	Prog. Interrupt Control	9.95
DP8275	Prog. CRT Controller	29.95
DP8279	Prog. Keyboard/Display Interface	9.95
DP8283	System Timing Element	6.95
DP8286	8-Bit Bi-Directional Receiver	3.95
DP8287	8-Bit Bi-Directional Receiver	3.95
DP8298	9-Bit Bi-Directional Receiver	3.95
DP8310	Octal Latched Peripheral Driver	5.25
DP8311	Octal Latched Peripheral Driver	5.25

6800/6800 SUPPORT DEVICES

MC6800	MPU	7.95
MC6802CP	MPU with Clock and RAM	14.95
MC6810AP1	128x8 Static RAM	4.95
MC6821	Peripheral Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	17.95
MC6830L8	1024x8-Bit ROM (MC6A30-8)	15.95
MC6850	Asynchronous Comm. Adapter	6.95
MC6852	Synchronous Serial Data Adapter	6.95
MC6860	0-600bps Digital MODEM	19.95
MC6861	2400bps Modulator	12.95
MC6880A	Quad 3-State Bus Trans. (MC8T26)	2.25

MICROPROCESSOR CHIPS

Z80 (70C)	CPU (MK3880N) (2MHz)	11.95
Z80A (780-1)	CPU (MK3880N-4) (4MHz)	13.95
COP1802	CPU	19.95
2650	MPU	19.95
INS8060	ADC CPU-4-Bit Snap (Com. Temp. Grade)	19.95
MC5040	MPU w/Clock (8K Bytes Memory)	13.95
INS8039N-6	MPU–6-Bit (6MHz)	7.95
INS8039N-8	CPU–Sgl. Chip 8-Bit (128bytes RAM)	9.95
INS8040N-6	CPU (256 Bytes RAM)	29.95
INS8070N	CPU–64 Bytes RAM	24.95
INS8070N	CPU w/Basic Micro Interpreter	29.95
9940	CPU	9.95
TMS9980JL	MPU–16-Bit	39.95

SHIFT REGISTERS

MM5004H	Dual 25-Bit Dynamic	.50
MM5003H	Dual 50-Bit Dynamic	.50
MM5064H	Dual 100-Bit Static	.50
MM5034H	Dual 64-Bit Accumulator	.50
MM5040N	256-Bit Dynamic	2.95
MM5013N	128-Bit Dynamic/Accumulator	1.95
MM5016H	500/512-Bit Dynamic	1.95
MM5038N	Octal 60-Bit	5.95
MM5035N	Octal 80-Bit	5.95
2504V(MM5A)	320-Bit Dynamic	1.95
2518H	Hex 30-Bit Static	2.50
2527V	Dual 132-Bit Static	2.95
2529V	512-Bit Dynamic	.99
2536V	1024-Bit Dynamic	2.95
2537V	Dual 256-Bit Static	2.95
2539V	Dual 250-Bit Static	4.50
2591V	Dual 240-Bit Static	4.50
2539N	Quad 80-Bit Static	2.95
2561PC	Fifo (Dual 80)	6.95

DATA ACQUISITION

AF100-1CN	Universal Active Filter 2.5%	5.95
AF120-1CJ	Touch Tone Low Band Filter	19.95
AF120-1CJ	Touch Tone High Band Filter	19.95
LM308CH	Super Gain Op Amp	1.25
LM334Z	Constant Current Source	1.39
LM335Z	Temperature Transducer	1.49
LF356N	JFET Input Op Amp	1.10
LF398N	Sample & Hold Amplifiers	3.95
LM399H	Temp. Comp. Prec. Ref. (.5oom/C°)	5.00
ADC0804LCN	8-Bit A/D Converter (1 LSB)	4.95
DAC0808LCN	8-Bit D/A Converter (0.19% Lin.)	2.25

DATA ACQUISITION (CONTINUED)

ADC0809CCN	8-Bit A/D Converter (8-Ch. Multi.)	5.25
ADC0817CCN	8-Bit A/D Converter (16-Ch. Multi.)	10.95
DAC1020LCN	10-Bit D/A Conv. Micro. Comp. (0.05%)	13.95
DAC1022LCN	10-Bit D/A Conv. Micro. Comp. (0.19%)	8.95
DAC1220LCN	12-Bit D/A Converter (0.05% Lin.)	9.49
DAC1221LCN	12-Bit D/A Converter (0.2% Lin.)	5.95
CD4890M	4-Channel Multiplexer	1.19
AY-5-1013	25K BAUD UART	6.95

RAM'S

1101	256x1 Static	1.49
1103	1024x1 Dynamic	.99
2101 (5101)	256x4 Static	3.95
2102	1024x1 Static	1.75
2112	256x4 Static	3.95
2114	1024x4 Static 450ns Low Power	3.49
2114-2	1024x4 Static 200ns	3.95
2114L-2	1024x4 Static 200ns Low Power	4.50
2125H	256x4 Static	6.95
4116H-4 (UPD416)	16K Dynamic 250ns (MM5290N-4)	7.75
4164H-3	64K Dynamic 200ns	19.95
MM5290	4096x1 Fast 70ns	7.95
5101	256x4 Static	7.95
MM5280	1024x1 Dynamic Fully Decoded	.99
MM5262	2Kx1 Dynamic	.49
MM5290/2107	4096x1 Dynamic	4.95
MM5290N-2 (4136)	16K Dynamic 200ns (UPD436C-3)	7.95
MM5298J-3A	8K Dyn. 250ns (lower ½ of MM5298J)	1.95
HM6116-4	16K (2Kx8) Static 200ns	14.95
6504Q	64 Bit Static (6540C)	3.49
UPD414/MK4027	4K Dynamic 16-pin	4.95
TMS4044-45PJL	4K Static	9.95
TMS4045	1024x4 Static	9.95

PROMS/EPROMS

1702A	2K UV Erasable PROM	5.95
1602A	2K EPROM	4.95
TMS9725	2Kx8 EPROM (5V, +5V, +12V)	9.95
2716 (Intel 2716)(TI)	16K EPROM (Single +5V)	9.95
TMS2716 (TI)	16K EPROM	17.95
2758	8K EPROM (450ns) (Single +5V)	7.49
2704Q	4K EPROM (Hitachi HN462704)	49.95
6330	32x8 PROM	14.95
82S23 (74S288)	32x8 PROM (Open Collector)	3.95
82S126	256x4 Bipolar PROM	14.95
82S123 (74S288)	32x8 Tri-State Bipolar PROM	3.95
82S129	1Kx1 PROM	16.95

— Over 30 More PROMS Listed in Our Catalog —

ROM'S

2513C (2408)	Character Generator (Upper Case)	9.95
2513L (2411)	Character Generator (Lower Case)	9.95

NMOS READ ONLY MEMORIES

MCM66700	128x8x7 ASCII Shifted w/Graph.	13.50
MCM66750P	256x7 Math Symbol & Pictures	13.50
MCM67760	128x8x7 Alpha, Control Char. Gen.	13.50

MICROPROCESSOR MANUALS

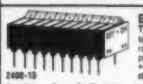
M-2128	User Manual	7.00
M-COP1802	User Manual	7.50
M-2650	User Manual	5.00

SPECIAL FUNCTION

DS8850CN	Dual MOS Clock Driver (8MZ)	3.50
DS8860CN	Dual MOS Clock Driver (8MZ)	3.95
INS1771N-1	Floppy Disc Controller	29.95
INS8251N	Communication Chip	29.95
MM5863TN	Microprocessor Real Time Clock	6.95
MM5837BN	Microprocessor Compatible Clock	12.95
COP402N	Microcontroller with 8-Digit RAM and Direct LED Drive	5.95
COP402MN	Microcontroller with 4-Digit RAM & Direct LED Drive w/N Bus Int.	7.49
COP478N	10-Seg. VAC Fluor. Driver (20-pin pkg.)	3.95

TELEPHONE/KEYBOARD CHIPS

AY-5-9200	Push Button Telephone Dialer	14.95
AY-5-9300	Repertory Dialer	14.95
AY-5-9900	CMOS Clock Generator	4.95
AY-5-2376	Keyboard Encoder (64 keys)	12.95
HC-5035-5	Keyboard Encoder (35 keys)	7.95
MC922	Keyboard Encoder (35 keys)	5.49
MC923	Keyboard Encoder (43 keys)	5.75
MM5232BN	Push Button Pulse Dialer	7.95
MM5740BN	98/256-Key Serial Keyboard Encoder	8.95



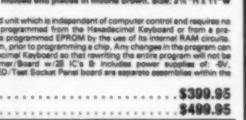
EECO Rocker DIP Switch — "Mini-Digrw" 2400 Series
THE MOST UNIQUE DIP SWITCH AVAILABLE!

MINI-DIP is designed to retrofit all major brands of Dip switches. Unique features include locking rod design to prevent accidental actuation and gold gold self-wiping contact. One-piece housing and press-fit terminals prevent contamination. 2-10 station Form "A" and 1-5 station Form "C".
• Terminals on .100 x .300 (2.54 x 7.62) centers • PCB or dip socket mountable • Positive cleaning/wiping action with gold contact • Total seal and bottom seal

2400-10

Part No.	Pos.	Configuration	Socket	Price	Part No.	Pos.	Configuration	Socket	Price
2400-2	2	12	8 pin	.79 - 10/ 6.95	2400-6	6	123456	14 pin	1.09 - 10/ 9.95
2400-3	3	123	8 pin	.89 - 10/ 7.95	2400-7	7	1234567	14 pin	1.19 - 10/10.95
2400-4	4	1234	8 pin	.99 - 10/ 8.95	2400-8	8	12345678	16 pin	1.29 - 10/11.95
2400-4BCD	4	ABCD	8 pin	.99 - 10/ 8.95	2400-9	9	123456789	18 pin	1.39 - 10/12.95
2400-5C	5	C54321	14 pin	1.09 - 10/ 9.95	2400-10	10	0123456789	20 pin	1.49 - 10/13.95

JE608 PROGRAMMER
2704/2708 EPROM PROGRAMMER



GENERAL APPLICATIONS:
- To program EPROMS 2704 and 2708.
- Developmental system for microcomputer circuits
- To read the contents of a pre-programmed EPROM
- To compare EPROM(s) for content differences
- To emulate a programmed EPROM
- To store program in RAMS for alterations
- Three separate Display Registers: 6 LED's for Hex Key entries, 10 LED's (2-5's) for Address Register and 8 LED's for Data Memory Register. The Data Memory Register displays the content of the RAMs from the EPROM Chip. Development of microprocessor systems by means of a ribbon cable from the programmer panel test socket to the EPROM socket on the microprocessor board. Rapid checking verification of programmed data changes. User may move data from a master to RAM's or write into RAM's with keyboard entries. Allows manual stepping manipulation (up and down) at any address location. Stand-alone EPROM Programmer consisting of: A 16-key Hexadecimal Keyboard assembly, Programmer Board assembly with 4 power supplies and a LED/Test Socket Panel Board assembly. The Test Socket is zero force insertion type. Power requirements: 115VAC, 60Hz, 6W. Compact desk-top enclosure: Color-keyed two piece display's case with light tan panels and molded end pieces in mocha brown. Size: 9¼ "H x 11"W x 8¼ "D. Weight: 5 lbs.

The JE608 EPROM Programmer is a completely self-contained unit which is independent of computer control and requires no additional systems for its operations. The EPROM can be programmed from the microcomputer Keyboard or from a pre-programmed EPROM. The JE608 Programmer can emulate a programmed EPROM by the use of its internal RAM circuits. This will allow the user to test or pretest a program for a system, prior to programming a chip. Any changes in the program can be entered directly into the memory circuits with the Hexadecimal Keyboard so that rewriting the entire program will not be necessary. The JE608 Programmer contains a Programmer/Board w/28 IC's & includes power supplies of: -9V, +9V, +12V and +28V. The Hexadecimal Keyboard and LED/Test Socket Panel board are separate assemblies within the system.

JE608K Kit **$399.95**
JE608A Assembled and Tested **$499.95**

JE608-16K ADAPTER BOARD FOR 2716/2708 EPROMS

GENERAL DESCRIPTION:
The JE608-16K Adapter Board allows the JE608 Programmer to be modified for the additional programming of the 2716 and 2708 EPROMS. The adapter provides for adding an address switch for the 2^11 bit and also for selecting the proper power and timing pulses to be applied to the EPROM. Programming and emulating the 2716 (16K) EPROM is done separately to each half (1024x8) of the EPROM because of the existing 8K RAM capacity in the JE608 Programmer.

JE608-16K	Adapter Board Kit	**$29.95**
JE608-Upgrade	(Send assembled JE608 to factory for adapter installation of the JE608-16K Adapter Board Kit)	**$99.95**
JE608A-16K Mod.	Assembled JE608 w/Adapter (JE608-16K) Installed	**$599.95**

$10.00 Min. Order – U.S. Funds Only
Calif. Residents Add 6% Sales Tax
Postage–Add 5% plus $1.50 Insurance

Spec Sheets – 25¢
Send 88¢ Postage for your FREE 1982 JAMECO CATALOG

NEW 1982 CATALOG!

Jameco ELECTRONICS

PHONE ORDERS WELCOME (415) 592-8097

MAIL ORDER ELECTRONICS – WORLDWIDE
1355 SHOREWAY ROAD, BELMONT, CA 94002 ↵38
PRICES SUBJECT TO CHANGE
2/82

BOOKS

National Semiconductor — Intersil — Intel

30001	National CMOS Data Book (640 pages) 74C, CD4000, and A/D Converters	46.95
30002	National Interface Data Book (704 pages) DP, DS8000, DS3600, DS75000, etc.	46.95
30003	National Linear Data Book (1376 pages) LM, LF, ADC, DAC, LH Series	46.95
30004	National Series 800 — Board Level Computer (224 pages)	14.95
30005	National TTL Logic Data Book (1024 pages) 7400, LS, L, H, S, and DM8000 Series	46.95
30006	Buy above (3) 30001, 2, 5 as a set	$119.95/set
30009	Intersil Data Book (1074 pages)	46.95
010405	Intel Component Data Catalog	$10.00
	Full data sheets for Intel's products incl. memory devices, microproc., peripherals & indust./mil. products (1328 pages)	
205410	Intel Peripheral Design Handbook	$7.50
	Full data sheets, appl. notes for Intel peripheral device components (664 pages)	

AC and DC Wall Transformers

With Universal Plug and 9V Battery Snap

Selective voltages: 6,9,12VDC. Polarity selection (+/-), six-foot line from adapter to plugs — pin-inch line from adapter to battery snap. 120VA/60Hz. 300mA.

Part No.	Input	Output	Price
AC 250	117V/60Hz	12VAC 250mA	$3.95
AC 500	117V/60Hz	12VAC 500mA	$4.95
AC1000	117V/60Hz	12VAC 1 amp	$5.95
AC1700	117V/60Hz	9VAC 1.7 amp	$3.95
DC0912	120V/60Hz	6,9,12VDC 300mA	$9.95
DV6000	120V/60Hz	6VDC 200mA	$3.25
DC800	120V/60Hz	9VDC 500mA	$3.95

CONNECTORS

DB25P	D-Subminiature Plug	$2.95
DB25S	D-Subminiature Socket	$3.50
D20418-2	Screw Lock Hdwr. (2) DB25S/P	2/$.99
DB51226	Cover for DB25P/S	$1.75
22/44SE	P.C. Edge (22/44 Pin)	$2.95
UG88/U	BNC Plug	$1.79
UG89/U	BNC Jack	$3.79
UG175/U	UHF Adapter	$ .49
SO239	UHF Panel Recp.	$1.29
PL258	UHF Adapter	$1.60
PL259	UHF Plug	$1.60
UG260/U	BNC Plug	$1.79
UG1094/U	BNC Bulkhead Recp.	$1.29

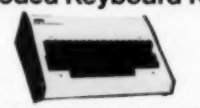
TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.

Kit comes complete with:
- ★8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (*NS)
- ★Documentation for Conversion

TRS-16K2 *150NS	$29.95
TRS-16K3 *200NS	$24.95
TRS-16K4 *250NS	$19.95

JE610 ASCII Encoded Keyboard Kit



The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly (62-keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and –12V @ 10 mA for operation. Features: 60 keys generate the 128 characters, upper and lower case ASCII set. Fully buffered. Two user-define keys provided for custom applications. Caps lock for upper-case-only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector. Size: 3¾"H x 14½"W x 8¾"D

JE610/DTE-AK	(After assembled as pictured above)	**$124.95**
JE610 Kit	62-Key Keyboard, PC Board, & Components (no case)	**$ 79.95**
K62	62-Key Keyboard (Keyboard only)	**$ 34.95**
DTE-AK	(case only – 3¾"Hx11"Wx8¾"D)	**$ 49.95**

NEW!

JE212 – Negative 12VDC Adapter Board Kit for JE610 ASCII KEYBOARD KIT
Provides -12VDC from incoming 5VDC . . **$9.95**

JE600 Hexadecimal Encoder Kit

FULL 8-BIT LATCHED OUTPUT 19-KEY KEYBOARD

The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Three user-define keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation. Size: 3½"H x 8¾"W x 8¾"D

JE600/DTE-HK	(After assembled as pictured above)	**$99.95**
JE600 Kit	19-Key Hexadec. Keyboard, PC Board & Cmpnts. (no case)	**$59.95**
K19	19-Key Keyboard (Keyboard only)	**$14.95**
DTE-HK	(case only – 3¾"Hx8¾"Wx8¾"D)	**$44.95**

↵See List of Advertisers on page 114

DEALER DIRECTORY

Phoenix AZ

The Southwest's most progressive communications company stocking Kenwood, Icom, Yaesu, MFJ, B&W, Astron, Larsen, Cushcraft, Hy-Gain, Bearcat, and more. Would like to serve you! **Power Communications Corp., 1640 West Camelback Rd., Phoenix AZ 85015, 241-Watt.**

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego. Call us for a low quote.

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Diego CA

We buy and sell Surplus Army Navy Electronics, also Terminated Material. What do you want to sell? Write for catalogue. **Electronicstown, Inc., 440-7th Avenue, PO Box 2048, San Diego CA 92112, 232-9379.**

San Jose CA
SAN FRANCISCO BAY AREA

Homebrewers' haven; tons of new and used Ham/Computer gear and components. Serving Hams since 1955. We specialize in ICOM, KLM, Mirage, Comptronix. We ship worldwide. **Tele-Com Electronics, 15460 Union Avenue, San Jose CA 95124, 377-4479.**

San Jose CA

Bay area's newest Amateur Radio store. New & used Amateur Radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1378 So. Bascom Ave., San Jose CA 95128, 998-1103.**

Miami FL

Amateur Radio Center, Inc. "Everything for the Amateur" Since 1960. **2805 N.E. 2nd Avenue, Miami FL 33137, 573-8383, TWX 522035.**

Smyrna GA

For your Kenwood, Yaesu, ICOM, Drake and other amateur needs, come to see us. **Britt's Two-Way Radio, 2500 N. Atlanta Rd., Smyrna GA 30080, 432-8006.**

Preston ID

Ross WB7BYZ, has the Largest Stock of Amateur Gear in the Intermountain West and the Best Prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Terre Haute IN

Your ham headquarters located in the heart of the midwest. **Hoosier Electronics, Inc., #9 Meadows Center, P.O. Box 3300, Terre Haute IN 47803, 238-1456.**

Littleton MA

The ham store of N.E. you can rely on. Kenwood, ICOM, Wilson, Yaesu, DenTron, KLM amps, B&W switches & wattmeters, Whistler radar detectors, Bearcat, Regency, antennas by Larsen, Wilson, Hustler, CAM. **TEL-COM Inc. Communications & Electronics, 675 Great Rd., Rt. 119, Littleton MA 01460, 486-3040.**

Ann Arbor MI

See us for products like Ten-Tec, R. L. Drake, Dentron and many more. Open Monday through Saturday, 0830 to 1730. WB8VGR, WB8UXO, WD8OKN and W8RP behind the counter. **Purchase Radio Supply, 327 E. Hoover Ave., Ann Arbor MI 48104. 668-8696.**

Hudson NH

New England's Distributor and Authorized Service Center for all Major Amateur Lines. **Tufts Radio Electronics, Inc., 61 Lowell Road, Hudson NH 03051, 883-5005.**

Somerset NJ

New Jersey's only factory-authorized ICOM and YAESU distributor. Large inventory of new and used specials. Most major brands in stock. Complete service and facilities. **Radios Unlimited, 1760 Easton Avenue, P.O. Box 347, Somerset NJ 08873, 469-4599.**

Amsterdam NY
UPSTATE NEW YORK

Kenwood, ICOM, Drake, plus many other lines. Amateur Dealer for over 35 years. **Adirondack Radio Supply, Inc., 185 West Main Street, Amsterdam NY 12010, 842-8350.**

Central NY

Amateur radio hardwood displays made to your specifications—callsigns, plaques, awards or special orders. High quality, fast service, low prices. **A.&M. Woodcraft, 313 N. Madison St., P.O. Box 243, Rome NY 13440, 337-5642.**

Syracuse–Rome–Utica NY

Featuring: Kenwood, Yaesu, ICOM, Drake, Ten-Tec, Swan, DenTron, Alpha, Robot, MFJ, Tempo, Astron, KLM, Hy Gain, Mosley, Larsen, Cushcraft, Hustler, Mini Products. You won't be disappointed with equipment/service. **Radio World, Oneida County Airport-Terminal Building, Oriskany NY 13424, 337-0200.**

Columbus OH

The biggest and best Ham Store in the midwest featuring quality Kenwood products with working displays. We sell only the best. Authorized Kenwood Service. **Universal Amateur Radio Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

Bend OR

Satellite TV. Known brands. Call today for more information and inquire about our dealer program. **WESPERCOM, P.O. Box 7226, Bend OR 97708, 389-0996.**

Scranton PA

ICOM, Bird, CushCraft, Beckman, Fluke, Larsen, Hustler, Antenna Specialists, Astron, Avanti, Belden, W2AU/W2VS, CDE, AEA, Vibroplex, Ham-Key, CES, Amphenol, Sony, Fanon/Courier, B&W, Ameco, Shure. **LaRue Electronics, 1112 Grandview St., Scranton PA 18509, 343-2124.**

Houston TX

Experimenter's paradise! Electronic and mechanical components for computer people, audio people, hams, robot builders, experimenters. Open six days a week. **Gateway Electronics Inc., 8932 Clarkcrest, Houston TX 77063, 978-8575.**

San Antonio TX

Complete 2 way service shop. Call Doc, W5FSP. Selling Antenna Specialists, Avanti, Azden, Bird, Hy-gain, Standard, Vibroplex, Midland, Henry, CushCraft, Dielectric, Hustler, ICOM, MFJ, Nye, Shure, Cubic, Tempo, Ten-Tec and others. **Appliance & Equipment Co., Inc., 2317 Vance Jackson Road, San Antonio TX 78213, 734-7793.**

Vienna VA

The Washington metropolitan area's leading supplier of the latest in Amateur Radio and Test Equipment. On your next trip to the Nation's Capital, stop by and see us. **Electronic Equipment Bank, Inc., 516 Mill St. N.E., Vienna VA 22180, 938-3350.**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '82 issue must be in our hands by February 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	7	7	7	7	7	7	7	7A	14	21	21A
ARGENTINA	14A	14	7	7	7	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	14	14	14	21	21A
CANAL ZONE	14	14	7	7	7	7	14	21	21A	21A	21A	21
ENGLAND	7	7	7	7	7	7	14	21A	21A	21A	14	7A
HAWAII	21A	14	7	7	7	7	7	7	14	21	21A	21A
INDIA	7	7	7B	7B	7B	7B	14	14A	14	14B	7B	7B
JAPAN	14A	14	7B	7B	7B	7	7	7B	7B	7B	14B	21A
MEXICO	21	7A	7	7	7	7	7	14	21A	21A	21A	21
PHILIPPINES	14	7A	7B	7B	7B	7B	7B	7	7	7B	14B	14
PUERTO RICO	14	7	7	7	7	7A	14	21	21A	21A	21	21
SOUTH AFRICA	14	7	7	7B	7B	7	14	21A	21A	21A	21	21
U. S. S. R.	7	7	7	7	7	7B	14	21A	21	14	7B	7B
WEST COAST	21A	14	7	7	7	7	7	14	21	21A	21A	21A

CENTRAL UNITED STATES TO:

ALASKA	21	7A	7	7	7	7	7	7	7A	14	21	21A
ARGENTINA	21	14	7A	7	7	7	7	21	21A	21A	21A	21A
AUSTRALIA	21A	14A	14	7B	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	14	14	7	7	7	7	14	14	21A	21A	21A	21
ENGLAND	7B	7	7	7	7	7	7B	21	21A	21	14	7B
HAWAII	21A	21	14	7	7	7	7	7	14	21	21A	21A
INDIA	7B	14	7B	7B	7B	7B	7B	7B	14	7A	7B	7B
JAPAN	21A	14	14B	7B	7B	7	7	7	7	7B	14	21A
MEXICO	14	14	7	7	7	7	7	14	14	21A	21A	21
PHILIPPINES	21A	14	7	7B	7B	7B	7B	7	7	7B	14B	14A
PUERTO RICO	21	14	7	7	7	7	7A	21	21A	21A	21A	21
SOUTH AFRICA	14	7A	7	7B	7B	7B	7	14	21A	21A	21A	21
U. S. S. R.	7B	7	7	7	7	7B	7B	14	21A	14	7B	7B

WESTERN UNITED STATES TO:

ALASKA	21A	14	7	7	7	7	7	7	7	14	21	21A
ARGENTINA	21A	14A	14	7	7	7	7B	14	21A	21A	21A	21A
AUSTRALIA	21A	21	14	7A	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	21	14	14	7	7	7	7	14	21	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	7A	21A	21	14	7B
HAWAII	21A	14A	14	7	7	7	7	7	14	21	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	7B	14	7A	7B	7B
JAPAN	21A	21A	14	7B	7	7	7	7	7	14B	14	21A
MEXICO	21	14	14	7	7	7	7	14	14A	21	21A	21A
PHILIPPINES	21A	21	14	7A	7B	7B	7B	7	7	14	14	21
PUERTO RICO	21A	21A	14	7B	7	7	7	7	14	21	21A	21A
SOUTH AFRICA	14	7	7	7B	7B	7B	7B	14	14A	21A	21A	21
U. S. S. R.	7B	7B	7	7	7	7B	7B	7B	14A	14	7B	7B
EAST COAST	21A	14	7	7	7	7	7	14	21	21A	21A	21A

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G/G	2 G/G	3 F/F*	4 F/F*	5 F/P	6 G/F
7 G/F	8 G/F	9 F/F	10 G/G	11 G/G	12 G/G	13 G/G
14 G/F	15 G/G	16 G/G	17 G/F	18 F/F	19 F/F	20 G/G
21 G/G*	22 G/F*	23 P/P	24 F/P	25 G/F	26 G/G	27 G/G
28 G/G						

NO CUT CORNERS!

FT-208R - 2 Meters
FT-708R - 70 CM

LIQUID CRYSTAL DISPLAY
The LCD frequency readout provides high readability night and day, along with very low current drain.

KEYBOARD FREQUENCY ENTRY
All operating frequencies are entered from the front panel keyboard. Unusual repeater splits, scanning, and memory programming are all controlled via the keyboard.

UP/DOWN MANUAL SCAN
The FT-208R scans in either 5 kHz or 10 kHz steps, while the FT-708R steps are 25 kHz and 50 kHz. Automatic halting on a busy or clear channel is provided, with automatic pause and restart feature. Scan either the band or the memories.

LIMITED BAND SCAN
You can program upper and lower frequency limits, then command the transceiver to scan that segment or exclude that segment.

TEN MEMORY CHANNELS
The memories may be used for either simplex or repeater operation. No need to throw a "5 UP" switch for those 15 kHz channels, either!

LONG-LIFE MEMORY BACKUP
A Lithium cell provides the memory backup function. Now you won't dump memory when switching battery packs.

LOW CURRENT DRAIN
Typical standby current drain is 20 mA, for long battery life.

450 mAH BATTERY PACK
With more capacity than competing packs, the FNB-2 battery pack gives you those precious extra minutes of operating time that might prove critical in an emergency!

HI/LOW POWER SWITCH
In the high power position, the FT-208R packs a wallop at 2.5 watts output, while the Ft-708R output is 1 watt. Switch to low power for 1 watt output on the FT-208R, 200 mW on the FT-708R, for even greater battery life.

PRIORITY CHANNEL
A priority channel may be programmed from the keyboard, allowing you to check a favorite channel while operating on another.

AUTOMATIC BAND AND MEMORY SCAN WITH PAUSE/RESTART
Automatic scanning of the band or memories (or a segment of the band) with pause and restart feature.

16 BUTTON DTMF PAD
For autopatch operation, a 16 button dual tone pad is built into every FT-208R and FT-708R.

PROGRAMMABLE SPLITS
The popular ±600 kHz shift is standard (±5 MHz on the FT-708R) on the FT-208R. Odd splits of up to 4 MHz may easily be programmed from the keyboard. Additionally, a split memory/dial mode provides a third method of operating on unusual splits.

OPTIONAL 32 TONE CTCSS
Easy interface is provided to the synthesized SSY-32 CTCSS Encoder, providing all 32 common subaudible tones for repeater operation.

LOCK SWITCH
The keyboard lock switch allows you to disable entry from the keyboard, thus preventing inadvertent frequency change.

FULL LINE OF ACCESSORIES
A Yaesu tradition, a full line of accessories is available to maximize your enjoyment of the FT-208R and FT-708R.

For more than a quarter of a century, Yaesu has produced reliable, high-performance communications equipment for the Amateur and Land Mobile services. Contact us today for full information on our cost-effective line of HF, VHF and UHF transceivers — at Yaesu we want you to get your message across!

Price And Specifications Subject To Change Without Notice Or Obligation

YAESU
The radio.

282

YAESU ELECTRONICS CORP. 6851 Walthall Way, Paramount, CA 90723 • (213) 633-4007
Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246 • (513) 874-3100

Dyna-"mite."

Photo shown is TR-7730 in 16-key autopatch UP/DOWN microphone version.

Miniaturized, 5 memories, memory/band scan

TR-7730

The TR-7730 is an incredibly compact, reasonably priced, 25-watt, 2-meter FM mobile transceiver with five memories, memory scan, automatic band scan, and other convenient operating features. The TR-7730 is available in two variations: a 16-key autopatch UP/DOWN microphone (MC-46) version, and a basic UP/DOWN microphone version.

TR-7730 FEATURES:

- **Smallest ever Kenwood mobile**
  Measures only 5-3/4 inches wide, 2 inches high, and 7-3/4 inches deep, and weighs only 3.3 pounds. Mounts even in the smallest subcompact car, and is an ideal combination with the equally compact TR-8400 synthesized 70-cm FM mobile transceiver.
- **25 watts RF output power**
  HI/LOW power switch selects 25-W or 5-W output.
- **Five memories**
  May be operated in simplex mode or repeater mode with the transmit frequency offset ±600 kHz. The fifth memory stores both receive and transmit frequency independently, to allow operation on repeaters with nonstandard splits. Memory backup terminal on rear panel.
- **Memory scan**
  Automatically locks on busy memory channel and resumes when signal disappears or when SCAN switch is pushed. Scan HOLD or microphone PTT switch cancels scan.
- **Automatic band scan**
  Scans entire band in 5-kHz or 10-kHz steps and locks on busy channel. Scan resumes when signal disappears or when SCAN switch is pushed. Scan HOLD or microphone PTT switch cancels scan.
- **Extended frequency coverage**
  Covers 143.900-148.995 MHz in switchable 5-kHz or 10-kHz steps.
- **UP/DOWN frequency control from microphone**
  Manual UP/DOWN scan of entire band in 5 kHz or 10 kHz steps is possible when using either autopatch or basic UP/DOWN microphone versions.
- **Offset switch**
  Allows VFO and four of five memory frequencies to be offset ±600 kHz for repeater access or simplex.
- **Four-digit LED frequency display**
  Indicates receive and transmit frequency.
- **S/RF bar meter and LED indicators**
  Bar meter of multicolor LEDs shows S/RF levels. Other LEDs indicate BUSY, ON AIR, and REPEATER offset.
- **Tone switch**

Optional accessories:

MC-46 16-key autopatch UP/DOWN microphone
SP-40 compact mobile speaker
KPS-7 fixed-station power supply

More information on the TR-7730 and TR-8400 is available from all authorized dealers of Trio-Kenwood Communications
1111 West Walnut Street
Compton, California 90220

KENWOOD
...pacesetter in amateur radio

Synthesized 70-cm FM mobile rig

TR-8400

- **Synthesized coverage of 440-450 MHz**
  Covers upper 10 MHz of 70-cm band in 25-kHz steps, with two VFOs.
- **Offset switch**
  For ±5 MHz transmit offset on both VFOs and four of five memories, as well as simplex operation. Fifth memory allows any other offset by memorizing receive and transmit frequencies independently.
- **DTMF autopatch terminal**
  On rear panel, for connecting DTMF (dual-tone multifrequency) touch pad (for accessing autopatches) or other tone-signaling device.
- **HI/LOW RF output power switch**
  Selects 10 watts or 1 watt output.
- **Virtually same size as TR-7730**
  Perfect companion for TR-7730 in a compact mobile arrangement.
- **Other features similar to TR-7730**
  Five memories, memory scan, automatic band scan (in 25-kHz steps), UP/DOWN manual scan, four-digit LED receive frequency display (also shows transmit frequency in memory 5), S/RF bar meter and LED indicators, tone switch, and same optional accessories.

Specifications and prices are subject to change without notice or obligation.